

# GÉRER & COMPRENDRE

« Se défier du ton d'assurance qu'il est si facile de prendre et si dangereux d'écouter »  
Charles Coquebert, *Journal des mines* n°1, Vendémiaire An III (septembre 1794)

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By Léna Masson & Anne Dietrich

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Le contenu des articles n'engage que la seule responsabilité de leurs auteurs

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Chaque article est donné, selon la règle du « double aveugle », à au moins deux rapporteurs, membres du comité de rédaction. Le comité fait appel à des évaluateurs extérieurs quand l'analyse d'un article suppose de mobiliser des compétences dont il ne dispose pas.

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**REJET / RE-SOUSSION** : Le matériau est jugé original et intéressant mais l'article pêche sur de trop nombreux points. Un travail de refonte très substantiel est requis. Si un nouvel article est soumis, il pourra être évalué par d'autres rapporteurs.

Gérer & Comprendre peut aussi évaluer les articles écrits en anglais.

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Même si Gérer & Comprendre, déborde la seule tradition clinique et expérimentale dont elle est née, elle se méfie des considérations théoriques déployées sans confrontation avec les faits.

Le plus souvent, les méthodes de validation statistiques laissent sceptique le comité, bien que plusieurs de ses membres (qui ne sont pas les moins critiques...) aient par ailleurs une large expérience de l'enseignement des méthodes mathématiques et statistiques ;

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Le fait de restituer des observations ou des expériences pose naturellement un problème : le chercheur n'étant ni un observateur invisible, ni un investigateur impassible, il importe de préciser comment ont été effectuées les observations rapportées, cela afin que le lecteur puisse juger par lui-même des perturbations qu'on pu occasionner les interactions entre l'auteur et le milieu dans lequel il était plongé ;

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On a longtemps rêvé de lois et de solutions générales en gestion, mais cet espoir ne résiste pas à l'observation; les articles qui proposent, soit des théories implicitement ou explicitement normatives, soit des recettes présentées comme générales, sont pratiquement toujours rejetés ;

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**INFORMATIONS PRATIQUES**

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# Overstaffing: Cost to be reduced, or slack to be encouraged?

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Overstaffing is commonly seen as a cost that should be reduced. However, our research, based on two industrial cases, presents company managers who advocate it. To analyze this counterintuitive result, we use the concept of organizational slack. The arguments of the managers are then structured around functions of organizational slack: overstaffing allows them to prepare for the future and to preserve their employees. Showing overstaffing as a slack to be favored is unusual in the present context, and questions more broadly the widespread representations of a workforce that must necessarily be reduced. Our research also sheds light on the concept of organizational slack by showing that it can be consciously rationalized by managers, and therefore be part of a reasoned managerial logic.

## Introduction

“Cut costs”, “slash budgets”, “scrutinize expenses”, “achieve cost excellence” – there is no dearth of expressions describing the need to eliminate all costs considered unnecessary. Such expressions, fueling the myth of the lean enterprise (Beaujolin, 1997, p. 265), are grounded in a logic of rationalization. The term “overstaffing” – insofar as it is defined as retaining “excess staff” (Dubouloy and Fabre, 2002, p. 45) – follows the same logic. This excess, when compared to a reference value considered normal, represents a cost and is therefore typically seen in a negative light (Bourguignon, 2005). The literature has repeatedly highlighted company managers’ preoccupation with personnel costs and personnel cost reduction (Beaujolin, 1999; Kuhn and Moulin, 2012). Yet, contrary to this observation, this paper presents two industrial case studies in which managers support and encourage overstaffing, despite a context of macroeconomic crisis.

The concept of “organizational slack” (Cyert and March, 1963) can be understood as latitude, superfluous capacity (David, 2012, p. 59), surplus resources or leeway for organizational actors. Overstaffing is widely acknowledged as a type of slack<sup>1</sup> called “excess labor” (Nohria and Gulati, 1997, p. 604) or “human slack” (Demirkan, 2018, p. 675). Previous research has shown that slack enables companies to adjust to their environment and to innovate (Cyert and March, 1963; Bourgeois, 1981; Nohria and Gulati, 1997; Leuridan and

Demil, 2021). Departing from the traditional approach to optimizing resources, this paper draws on the functions of slack to formalize the positive impact of overstaffing in two case studies. The following analysis offers two original insights into organizational slack – the first about an unexpected adjustment of overstaffing in times of crisis and the second about the conscious rationalization of slack. Making both empirical and conceptual contributions, this interdisciplinary study calls into question the myth that managers should always aim to reduce staffing levels. This myth is further challenged by the context of crisis which surrounds our case studies, putting standard management practices to the test.

After providing an overview of the literature on overstaffing and on the functions of organizational slack, we will present our methods and give a detailed description of our two industrial case studies. Finally, we will focus on contextualizing our findings and discussing their impact.

## Overstaffing as a cost to reduce vs overstaffing as organizational slack

### Overstaffing as a cost to reduce

The term “overstaffing” has been discussed by a number of researchers, but the Larousse dictionary seems to provide the clearest definition. It defines overstaffing as the provision of a number of employees deemed excessive, which is interesting for two reasons. Firstly, the use of “deemed” refers to organizational

<sup>1</sup> In this article, we will use the expression ‘organizational slack’ or ‘slack’ interchangeably.



actors' mental representation of optimal staffing levels. Secondly, in line with Dubouloy and Fabre's (2002, p. 45) academic definition, the word "excessive" highlights the idea of a surplus compared to a reference value considered normal.

Previous studies have attempted to formalize methods for determining this reference value, which represents optimal staffing needs. These methods, from the standard one (Bassett, 1973) to more sophisticated iterations (Ernst *et al.*, 2004), mainly rely on task timing and Taylorism (1903). Taylor, at the time, already advocated labor cost minimization – an approach which lived on through Toyotism, according to Coriat's (1994) work, with its ideals of "lean manufacturing", "flexible manufacturing" and, therefore, of "minimum staffing levels" (p. 22).

Aside from the usual criticisms levied against Taylor, multiple researchers (Mallet, 1989; Baraldi and Troussier, 1998) argue that the methods used to determine staffing needs (and therefore overstaffing) tend to build in the idea that needs should be kept to the strict minimum. This criticism is consistent with the literature on job cuts, which casts doubt on the theory that layoffs necessarily have a positive impact (Boyer, 2002) and points out the accounting-driven approach that is prevalent in workforce management. The financialized representation of labor, which records labor as a loss on the P&L statement and does not include it as an asset on the balance sheet (Beaujolin 1997, p. 67), seems to point to staff reduction as a way to increase company profits. Indeed, all costs have a negative connotation (Bourguignon, 2005) and staffing levels often pay a heavy price (Chevalier and Dure, 1994, p. 8). Managers are driven by management theories often focused on overstaffing (Kuhn and Moulin, 2012), a phenomenon Beaujolin (1999) calls the weakest link of cost rationalization (p. 121). Bernier-Khedache's (2019) recent study shows that this drive towards downsizing continues to exist at all levels of workforce management.

### Overstaffing as organizational slack

Cyert and March (1963) aimed to build a behavioral theory of the firm explaining specific decision-making processes, including as regards the internal allocation of resources such as time, budget and staff. In this context, they introduced the concept of organizational slack, defined as "the difference between total resources and total necessary payments" (p. 40). Slack is then often seen as an excess of resources (Bourgeois, 1981; Nohria and Gulati, 1997; David, 2012; Scilien and Rozin, 2015; Demirkan, 2018; Leuridan and Demil, 2021). Some researchers (Nohria and Gulati, 1997) refer directly to overstaffing as a type of slack, as it is, by definition, excess labor. Demirkan (2018, p. 675) uses the concept of "human slack", which is "the investment in capabilities and skills in human resources above the level required for task completion".

Challenging the idea that slack is entirely wasteful, research has found that it serves various organizational functions. The first function of slack is to enable firms

to adjust to their environment by accumulating slack during periods of growth, which then becomes a buffer during economic downturns (Cyert and March, 1963, pp. 40-41) – as later supported by Bourgeois (1981), Nohria and Gulati (1997), and Demirkan (2018). This buffer can take different forms, such as opportunities for cost reduction (Cyert and March, 1963), cash or capital reserves (Nohria and Gulati, 1997), or "excess labor" (Nohria and Gulati, 1997, p. 604). The latter reflects the conception of overstaffing as something to be reduced.

Cyert and March (1963) identified a second, now widely accepted function of slack: it fosters the adoption of innovations by firms (p. 238). More broadly, slack seems to be a driver of organizational change (Leuridan and Demil, 2021), especially regarding strategic changes (Bourgeois, 1981). Overall, slack helps organizations prepare for the future by enabling innovation and change.

Some researchers point to a third, less common function pertaining more directly to human resources. Nohria and Gulati (1997) argue that slack fosters cooperation and prevents conflicts. In this role, slack reduces the risk of workforce burnout (Scilien and Rozin, 2015, p. 16) and helps employees stay healthier.

According to Cyert and March (1963, p. 41), though slack may serve these three functions, it is not necessarily rationalized by organizational actors. They explain that "we have seen no significant evidence for the conscious rationalization of slack in business firms". Bourgeois (1981), who echoes and supports this claim, laments the dearth of information and calls for more research to be conducted on the conscious rationalization of slack. Though Symeou *et al.* (2019) claim to contribute to this knowledge, their study leverages databases instead of discussions with organizational actors. Their point of view on the companies they study therefore remains external. Leuridan and Demil (2021), presenting several situations in which a hospital's critical care unit staff intentionally draws on slack resources, provide a glimpse into managers' attitudes towards slack resources. They do not, however, focus on its conscious rationalization. Knowledge on the topic therefore remains rudimentary to date.

## Methods

Finding atypical opinions among managers requires a close examination of the decision-making process, which is why this study is based on two in-depth case studies centered on companies that we will call WheelsCo and WeldingCo. The data was collected through semi-structured interviews (12 and 18, respectively), non-participant observation (over one and two months, respectively) and secondary data. We gathered the data in 2012-2013 at WheelsCo and in 2013-2014 at WeldingCo. This work gave us a thorough understanding of the actors' organizational and decision-making contexts, which then enabled us to determine, as precisely as possible, the extent of the actors' knowledge when they take action (Dumez and Jeunemaître, 2005, p. 996).

We decided to present these two case studies together because they share characteristics going beyond the methods used for data collection. We found, in both case studies, positive conceptions of overstaffing. Moreover, both companies belong to the industrial sector, amid a macroeconomic crisis. They are also both under economic or financial pressure – WheelsCo incurred debt from a leveraged buyout (LBO) and WeldingCo expects all of its construction projects to be profitable, as projected. Finally, though this study focuses on the industrial sector, it can be compared to other research conducted during the same time period, such as that of Perez *et al.* (2015) which looks at companies with a similar size profile and a comparable economic context.

Driven by an abductive-based approach, we alternated between coding and reviewing the literature. We first conducted a thematic coding of the literature on overstaffing, from which the concept of slack emerged as relevant to our research. We then carried out a more theoretical coding to deepen our analysis.

Given the richness of information in each case study, we interviewed a limited number of managers with a positive view of overstaffing. As our goal is to highlight this counterintuitive approach to overstaffing, our findings particularly emphasize conversations with these actors. At the time of data collection, they each had nearly 30 years of professional experience, including at least ten years in leadership positions. Both also hold MBA degrees from reputed and prestigious institutions.

In the following section, case study overviews will highlight, on the one hand, how overstaffing is

determined and, on the other, how managers perceive this overstaffing.

## Overstaffing in two industrial case studies

### Overstaffing at WheelsCo

#### Case study overview

WheelsCo is an industrial SME that has been based in western France since the 1990s. It specializes in the manufacture of steel wheels using a process in which a disc is stamped, machined and then welded to a bare rim. Once assembled, the wheels are then painted according to the customer's request. WheelsCo specifically serves business customers in the transport, civil engineering and agricultural equipment sectors.

In 2010, the company was acquired by its CEO (a graduate of the prestigious École Polytechnique, École des Ponts ParisTech, and of the HEC MBA programme) through an LBO-type financial arrangement. The company's turnover for 2011 stood at €4.6m, with 18 permanent employees as of 31 December 2011. At the time of data collection, WheelsCo's economic situation had taken a turn for the worse. The company, which was still reeling from the impact of the 2008 financial crisis, needed to repay the debt incurred from the LBO. The CEO, who was particularly concerned about this issue, said: "The thing that would keep me up at night is if I wasn't able to pay off my debts. That could happen, you know! But for now, that's not the case". WheelsCo's

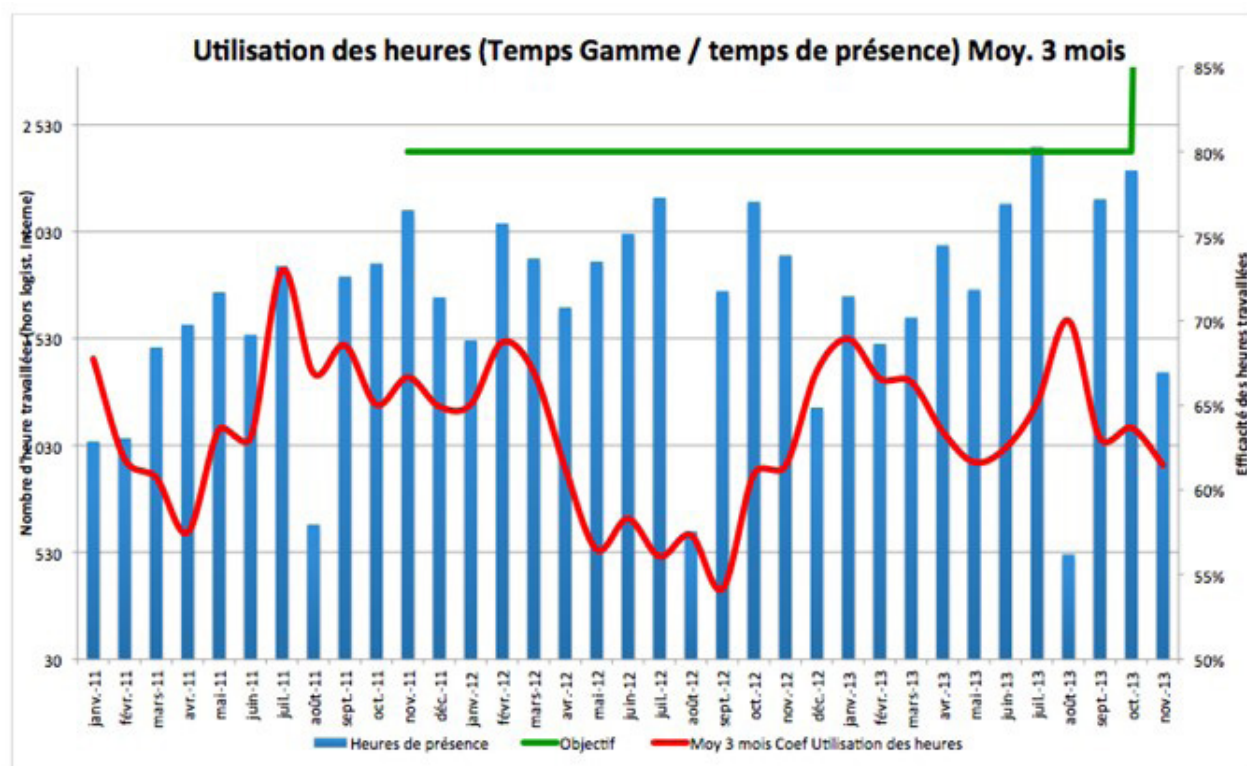


Figure 1: Time utilization rate at WheelsCo (source: WheelsCo dashboard at end-November 2013).

Français	English
Utilisation des heures (Temps Gamme / temps de présence) Moy. 3 mois	Three-month average of the time utilization rate (allocated task time/on-site time)
Nombres d'heures travaillées (hors logist. Interne)	Number of hours worked (excluding internal logistics tasks)
Efficacité des heures travaillées	Efficiency of hours worked
Heures de présence	On-site time
Objectif	Target
Moy 3 mois Coef Utilisation des heures	Three-month average coef. of the time utilization rate
janv.	Jan
fév.	Feb
mars	Mar
avr.	Apr
mai	May
juin	Jun
juil.	Jul
août	Aug
sept.	Sep
oct.	Oct
nov.	Nov
déc.	Dec

pressing financial situation created an incentive for resource optimization.

### Identifying overstaffing

The CEO developed the indicators he needed and tracked them closely. During our conversations, he also analyzed the data himself. Aside from indicators on the company's commercial situation (*i.e.* number of orders and order amounts) and on the service offered (*i.e.* deadline monitoring), the CEO tracked an indicator called the "time utilization rate", represented below as a chart:

This chart, which covers the entire time of contact with WheelsCo (from February 2012 to November 2013), displays data on a monthly basis (as shown on the x-axis). The left-hand y-axis shows the hours worked using bars. The curve represents the three-month rolling average of the on-site hours utilization coefficient (allocated task time<sup>2</sup> divided by on-site time), which can be read on the right-hand y-axis as a percentage. Finally, the chart shows the target time utilization rate (80%, as read on the right-hand y-axis) as a horizontal line.<sup>3</sup>

Periods of overstaffing in the manufacturing unit can be

<sup>2</sup> We are using WheelsCo's terminology. Allocated task time actually refers to employees' work hours as recorded by the timekeeping system, and not to task time estimations (allocated task time).

<sup>3</sup> We do not have an explanation as to why the "Target" line becomes vertical starting in October 2013. This does not cause any issue for our analysis of the case study.

identified by looking at the curve, which is how the CEO detected overstaffing in 2011 and 2012:

"During these two years, there were two employees who were not absolutely necessary".

Given WheelsCo's staffing levels, this two-person surplus is significant – it represents about 10% of the total workforce.

In the next sections, we will examine WheelsCo's analyses and thought process on staffing levels. Following on from presenting the company's indicators, we will first discuss direct labor (DL) before turning to a situation involving indirect labor (IL).

### Explanations from the CEO about overstaffing in the manufacturing unit

Firstly, the CEO explains overstaffing using "technical" factors:

"In a way, it's because our staffing levels are incremental. Hiring one additional employee increases employee contributions by 5 or even 7%. So, we can't do everything all at once... If there were 150 employees and everything, I'd say... You wouldn't even notice it! We wouldn't be talking about it".

Here, two technical factors seem to be at play. The first is the significant proportion overstaffing represents compared to the company's size. The second is about what the CEO calls "incremental" staffing levels, when he alludes to hiring an additional worker though his business needs might only be quantified at 0.72, for example. The option of hiring part-time workers was never discussed. Additionally, overstaffing at WheelsCo

does not stem from one specific job, but is dispersed throughout the company:

“The problem is that it's bits of people, so it's kind of tough” (CEO).

Aside from technical factors, overstaffing at WheelsCo is weighed against other aspects, such as the company's responsiveness:

“These past two years, we had two workers who were not absolutely necessary. But if things pick back up... We are a services company; we need to guarantee the same level of service all the time” (CEO).

Overstaffing is also balanced with employee health:

“We could have one fewer worker if everyone had the right level of efficiency. But it would be tight! We would be asking too much from people. It wouldn't be healthy in the long run” (CEO).

In this excerpt, the CEO worries about staff members' physical and mental health. He acknowledges the fact that, even with the “right level of efficiency”, firing an employee would lead to unsustainable work conditions in the long term.

As a result, staffing levels are not “automatically” adjusted. More precisely, the CEO wants to delay adjusting staffing levels down based on order levels:

“... right now, work is scarce because of the crisis, I don't want to change anything right now but if the situation lasts three or four months, we'll reduce temp work, then... We have a hard time – I mean, at least I have a hard time making decisions on the spot, just because I saw an indicator change a certain way. There needs to be a few indicators going in the same direction before I go 'ok, well, that's enough now” (CEO).

The CEO remains preoccupied with adjusting staffing levels and, in later conversations, he mentions the different adjustments he has made:

[On adjusting resources]

“Well, we reduced them, we adjusted them and now, we're sort of hiring more temps because we're right at the limit. But we have work for the next two weeks, but in three weeks there shouldn't be any more work” (CEO).

In this excerpt, the CEO explains that temporary work has fluctuated over the period – first dropping, then increasing slightly, though customer demand is relatively low.

### **Explanations from the CEO about hiring a quality manager**

In early 2012, the CEO starts recruiting for a quality manager. He acknowledges that this hire will “make the organization heavier” but also that “hiring a quality manager was necessary to gain access to new markets with stricter requirements regarding longevity and precision”. Given WheelsCo's financial context, the CEO adds that “the hiring cost was logically covered by a customer order; though it won't cover all of it because the requirements are more demanding and we'll be less productive”. However, his reasoning is not limited to financial factors:

“The cost will be borne by all our customers, though it will benefit only some. And it increases the team's skills and enables us to consider internal replacement opportunities”.

This hire is justified by new customers' requirements and is based on calculations (“covered by a customer order”) which are, however, unfavorable and might bring the hiring process to a stop (“though it won't cover all of it because the requirements are more demanding and we'll be less productive”). Yet, this imbalance does not prevent the CEO from making a hire. On the contrary, the hire is maintained, confirmed and even justified with other arguments which, according to the CEO, balance out potential negative impacts (e.g. increasing team skills and being able to replace workers internally).

WheelsCo's case illustrates multiple aspects of overstaffing and its representations. After presenting the WeldingCo case study in the next section, we will then analyze both cases together.

## **Overstaffing at WeldingCo**

### **Case study overview**

WeldingCo is a company located in north-eastern France with about 1,000 full-time equivalent (FTE) workers. The company specializes in pipeline maintenance and large-scale construction projects, mainly in the nuclear industry. After being impacted by decades of fluctuations in the nuclear market, the company's outlook is now extremely favorable. Indeed, the Fukushima accident of 11 March 2011 called attention to the issue of nuclear security. As a result, the company expects to grow “until 2020”<sup>4</sup>, aiming to hire an additional 200 FTE workers:

“The strategic committee established this +200 goal. It's based on the business forecast for 2015, with growth driven by nuclear maintenance contracts. To be ready in early 2015, we need to start hiring in 2014, so new employees can be fully integrated into the company and trained” (Chief Human Resources Officer).

“[WeldingCo], which already generates 70% of its turnover in the nuclear industry, is guaranteed to be fully booked for at least 15 years, provided they can find the staff they need”. From “[WeldingCo]. Des hommes et de la croissance”, published in *Le Journal des entreprises* (a French business news magazine) on 1 October 2013.

As highlighted in these excerpts, hiring 200 FTE workers is a significant challenge because WeldingCo jobs require highly technical skillsets that take time to acquire. The Chief Human Resources Officer supports overstaffing, as opposed to a workforce optimization approach.

### **Identifying overstaffing**

Increasing the volume of jobs goes against the traditional workforce optimization approach, which is particularly prevalent among site managers because of price competitiveness in the tender process, but also because of site manager assessment criteria:

“Operations managers fear work underload. On a five-week project, a week of underload can jeopardize profitability and

<sup>4</sup> Quote from an interview with a regional HR Manager.



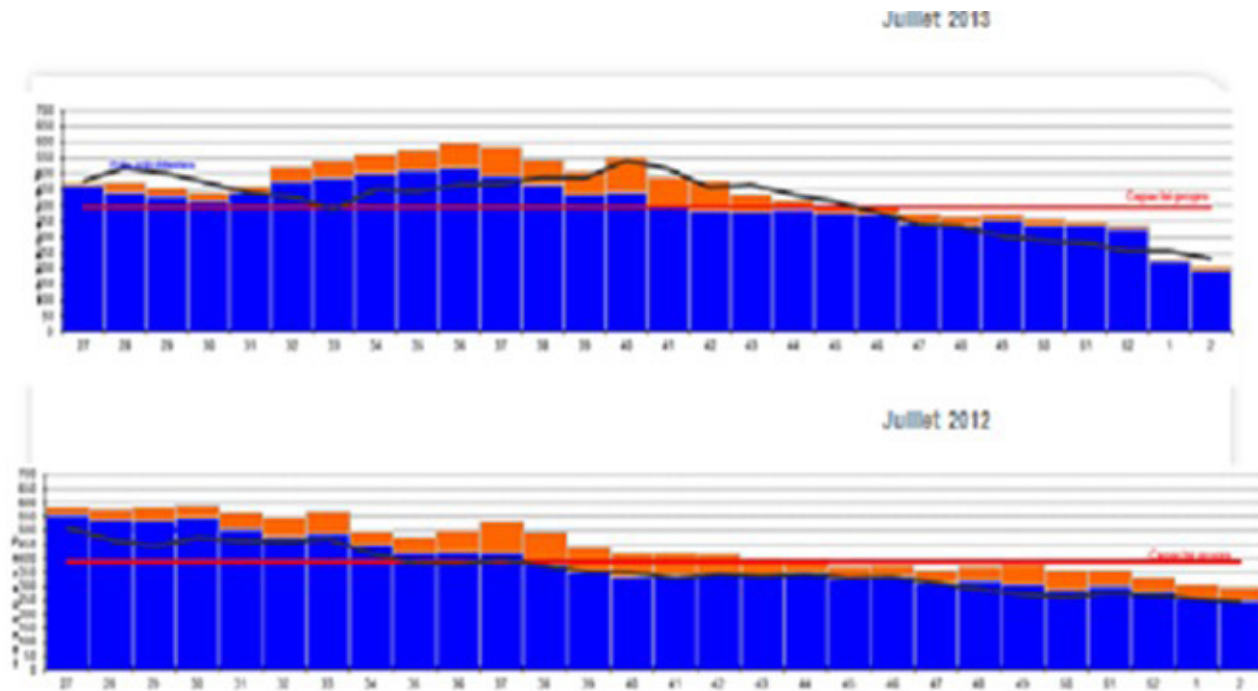


Figure 2: Projected workload capacity for all WeldingCo regions (source: Operations Department presentation to the WeldingCo Management Committee on 10 July 2013).

Français	English
Juillet 2013	July 2013
Juillet 2012	July 2012

operations managers worry about being judged for that” (Human Resources Manager).

Concerns about work underload are often mentioned by site managers, who are mostly assessed based on financial indicators that consider staff as a short-term expense. Recruiting, then, represents an expenditure instead of a means of securing future contracts. Monitoring methods also follow this logic. Business managers use a management software package that allows them to precisely track hours and spending, and to determine the profitability of each project. At national level, the head office Financial Controller participates in project monitoring and “notifies relevant managers when an unusual overrun occurs”<sup>5</sup>.

Workload capacity tools allow managers to assess whether staffing levels are sufficient to meet company needs, as summarized in the chart (Figure 2).

This chart compares the number of planned hours to the number of hours that are theoretically available. The blue histogram bars indicate the planned hours for confirmed orders, while the orange histogram bars chart orders that the company is highly likely to obtain. Quotation specialists determine the number of hours when responding to calls for tenders – using ratios to

match customer needs to company capabilities – and try to limit them to what is “strictly necessary”<sup>6</sup>. Workforce needs are therefore kept to a minimum. The straight line represents the theoretical capacity of available workers (*i.e.* the number of available work hours). A coefficient representing efficiency, and particularly mobilization and demobilization, was applied to the curve, taking into account regional staff transfers, temporary work and subcontracting. The level of workload can be analyzed by examining the chart:

“In the end, I have these curves which give me information about whether I’m in line with what I need to do, or whether I’m under or over-staffed” (Director of the Methodology and Strategic Planning Department).

Most weeks, available hours generally seem to fall short of the actual workload by a small margin. This confirms that ideal staffing levels at WeldingCo enable all workers to be busy without fully covering the workload. Due to dynamic markets, the company even relies on “recurring temporary employees” – an expression used in the budget procedure for 2014. Moreover, being able to deal with uncertainty is important for workforce management. Tools only track confirmed workload at a certain point in time. Beyond 16 weeks, workload tends to decrease because orders are not yet confirmed. This

<sup>5</sup> Quote from an interview with the Financial Controller.

<sup>6</sup> Quote from an interview with a Quotation Specialist.

apparent work underload explains why hiring is often postponed and fuels a logic of downsizing.

The previous chart therefore illustrates the idea of a minimum standard in terms of staffing levels, with each pocket of overstaffing being an anomaly. Nevertheless, members of HR are in favor of overstaffing, putting forward several arguments. It is important to note that the Chief Human Resources Officer, who holds an MBA, has worked in many corporate groups and takes part in the company's strategic decisions.

### **Explanations from the Chief Human Resources Officer about overstaffing**

The Chief Human Resources Officer makes several arguments on various levels. Firstly, from a strategic point of view, he highlights the time needed to train new hires:

"The point of the HR process here is that HR is forward-looking. Hiring temps and subcontractors is fine, but you can't learn our profession in 48 hours. And so, to replace Maurice, who is retiring, a temp won't do. Because the temp doesn't have the experience, the dexterity, the skills. And so, to replace Maurice, I need someone with ten years of experience and I don't know how to find that someone on the market, so I have to create them. That's why we use a forward-looking workforce planning system, which allows us to think differently".

"But senior management should also have a long-term vision over two or three years, a bit further into the future. They should tell themselves, 'What does my age pyramid look like? If I have 100 employees this year, I won't have 100 next year because a few people will quit and others will retire...' So thinking about increasing and decreasing staffing levels also needs to be done with a medium-term view, and then we're not proportional to the business activity levels, we're taking risks".

For the Chief Human Resources Officer, then, the specific nature of the profession and WeldingCo's growth prospects require "taking risks", meaning maintaining staffing levels above what is strictly necessary on the short term.

On another level, the Chief Human Resources Officer questions the company's business model. He highlights the limits of workforce optimization, which leads to turnover losses and overspending. With this criticism, he advocates hiring more people:

"[WeldingCo] doesn't accept no-margin projects even though this could allow us to train younger workers on simpler projects. I try to push for this in Management Committee meetings. In reality, [WeldingCo] refuses orders because of a lack of workforce!"

"In terms of staffing levels, operations managers thinks that if the available workforce isn't sufficient, we need to use subcontractors. This causes multiple issues: subcontracting is expensive and, on top of that, subcontractors develop skills that [WeldingCo] doesn't collect".

"At a company like [WeldingCo], the value we add is what we sell, it's the hours and the skills that we sell to customers. And if we think only in the short term, we won't hire anyone, and then we won't have anything to sell anymore".

Finally, the Chief Human Resources Officer mentions an operational issue:

"Managers say, 'Be careful, underload is coming', but we realized during Management Committee meetings that we can't give people time off".

Here, the Chief Human Resources Officer highlights the contradiction between a supposed work underload and an actual work overload of the staff, which supports the hiring of additional workers.

## **Organizational slack as a foundation for positive representations of overstaffing**

In this section, we will first explain the counterintuitive nature of overstaffing in our two case studies. We will then build arguments in favor of overstaffing based on the functions of slack identified in the literature. Finally, we will examine how our research adds to the existing knowledge on organizational slack.

### **A counterintuitive approach to overstaffing**

The issue of overstaffing is present at WheelsCo and WeldingCo as there are, in both companies, workers not deemed essential at a given time. Overstaffing is not identified specifically through research methods, instead it is detected directly by organizational actors<sup>7</sup>. In both case studies, it mostly affects manufacturing staff categorized as direct labor. At WheelsCo, it only marginally affects corporate employees, with the hire of a quality manager.

Given the context of macroeconomic crisis and the internal financial pressure these companies face, their approach to overstaffing is counterintuitive – they are both overstaffed or plan to be overstaffed in production and manufacturing. Workforce, then, is not adjusted according to the companies' activity levels, unlike in Perez *et al.*'s (2015) case studies during the same period<sup>8</sup>. Our case studies are also counterintuitive in the light of the literature on managers' preference for job cuts (Beaujolin, 1999; Kuhn and Moulin, 2012). We could, of course, claim that managers are strategically retaining rare resources (in welding, for example), or that the workforce has not yet been adjusted according to business activity levels. However, these arguments do not apply to our case studies. As we will demonstrate in the next section, managers use other reasons, based on organizational slack, to defend overstaffing.

### **Arguments for overstaffing based on the functions of slack**

The concept of slack helps shed light on overstaffing by providing an explanation for its benefits using the functions of slack as introduced in the literature, going beyond solely technical explanations which are not exhaustive (e.g. WheelsCo's issue with "bits of people").

<sup>7</sup> Note that the process of identifying overstaffing in our case studies is less formal than that used in past studies (Bassett, 1973; Ernst *et al.*, 2004).

<sup>8</sup> Except for one company, which decreased staffing levels as business activity grew.

Firstly, the managers we interviewed advocate overstaffing as a way to prepare for the future. This function is illustrated in two ways: overstaffing enables the company to meet future customer demand and allows for employees to be trained for projects in the near or distant future. In the first aspect, organizational actors anticipate an increase in the companies' activity levels, and tolerate overstaffing in the meantime, going against the traditional approach of keeping staffing levels to a minimum standard. This is all the more significant for WheelsCo, whose prospects of recovery are uncertain. In the second aspect, overstaffing facilitates staff training – especially at WeldingCo where training requires more resources and time due to the specific nature of the skills needed. WheelsCo's CEO also puts forward this argument, claiming that overstaffing "increases the team's skills and enables us to consider internal replacement opportunities". The managers also argue that, once acquired, these skills remain within the company, avoiding a situation where "subcontractors develop skills that [WeldingCo] can't build on".<sup>9</sup> Having leeway enables companies to undertake additional projects on top of their daily tasks. This is ultimately what WeldingCo's manager wants when he advocates overstaffing, which supports the company's current activity level but also enables employee training for future projects.

A second function of slack can be also identified in our interviews with managers – helping employees stay healthier. Though increasing employee workload could have boosted company output, HR considerations seem to take precedence. For example, WheelsCo's CEO claims that "We would be asking too much from people. It wouldn't be healthy in the long run", which is directly related to this function of slack. Overstaffing, then, enables employees to stay healthier.

Our analysis shows that managers' arguments are based on the functions of slack. Understanding overstaffing as a cause of slack and demonstrating the link between these two concepts, as this paper does, adds to the existing knowledge of overstaffing by some of its benefits. This finding provides two novel insights into organizational slack.

### Novel insights into organizational slack

The two case studies initially show that slack does not always help companies adjust to their environment. They subsequently demonstrate that managers are aware of and accept the existence of slack in their companies, adding to the research that exists so far.

#### Adjusting to the environment

The literature shows that organizational slack acts as a buffer during economic downturns, allowing companies to generate savings (Cyert and March, 1963; Bourgeois, 1981; Nohria and Gulati, 1997; Demirkan, 2018). During recessions, overstaffing represents "excess labor" that should be reduced or even eliminated. However, this is not the case in our data – WheelsCo remains overstaffed in a period of economic crisis. Following

this logic, overstaffing therefore does not act as a "buffer", as has often been posited. Our research offers a novel conceptual approach to the phenomenon. Overstaffing, then, does not act only as a buffer but also has two additional functions, as shown in the previous section. Moreover, the fact that WheelsCo remains overstaffed, therefore holding onto slack, worsens the company's financial situation. In this case, slack does not help the company adjust to the environment, as it increases certain difficulties instead of limiting them. To our knowledge, this is the first time that organizational slack is found not to play an adjustment role. This finding highlights the fact that, even in times of crisis, reducing all types of slack does not seem to be an absolute necessity.

#### Consciously rationalizing slack

Though initial theories found no evidence for the conscious rationalization of slack by organizational actors (Cyert and March, 1963; Bourgeois, 1981), recent research suggests otherwise. Symeou *et al.* (2019) claim to observe conscious rationalization of slack, but do have the adequate research methods. Leuridan and Demil (2021) also imply a conscious rationalization of slack based on manager interviews. Our research goes a step further. The managers we met clearly mention the benefits of slack and advocate overstaffing, contrary to traditional perceptions on the topic. Our findings, which are based on direct interviews with organizational actors, therefore mark a significant step forward on the issue of the conscious rationalization of slack. Adding to initial theories of slack, they provide insight into the way slack can manifest itself in organizations through organizational actors' arguments. In addition to previous research which has mainly analyzed it from an overarching organizational perspective, this finding calls for new research to be conducted at a more granular level. Indeed, if organizational actors are aware of slack, they can anticipate and use it as a resource in various ways. More research can then be conducted to better understand how it is used, in line with Leuridan and Demil's (2021) study on slack and frontline healthcare workers.

While organizational actors may be aware of slack and its benefits, they may not share their reasoning with all stakeholders. In some cases, the extensive literature on the benefits of slack can collide with the negative perceptions of overstaffing. In our case studies, actors who defend overstaffing have to contend with more traditional points of view. They use two different strategies. At WheelsCo, the CEO does not tell his financial stakeholders that the company is overstaffed. At WeldingCo, the issue of overstaffing creates conflicts between members of HR, who express and uphold their position, and operations managers. Though we have not observed overt defiance from operations managers, their practices are aimed at reducing overstaffing. For instance, they do not ask for additional hires, and are

<sup>9</sup> Quote from an interview with WeldingCo's Chief Human Resources Officer.



reticent to integrate new hires in construction teams<sup>10</sup>. For WeldingCo, we do not have any information on disclosures specifically made to shareholders and banks. However, the desire to increase staffing levels is shared publicly, for example in the local press and in *Le Journal des entreprises*. These articles allude to the benefits of overstaffing, insistently mentioning the need to “anticipate”, which reflects the necessity to start recruiting in 2013 in order to be ready for construction projects in 2015. Though WeldingCo managers do not explicitly advocate overstaffing in the press, organizational slack is still somewhat present when they talk about planning for the future. In the end, though we might have expected slack to be dealt with in an almost clandestine way, our findings paint a more complex picture.

## Conclusion

This study, which focuses on managers’ understanding of overstaffing in companies, makes conceptual and managerial contributions.

Firstly, though the literature has shown managers’ inclination towards making job cuts (Beaujolin, 1999; Kuhn and Moulin, 2012) and considering slack as “waste” (Nohria and Gulati, 1997, p. 609), the managers we interviewed hold a positive view of what is usually considered as a cost. Far from being negligent, they deliberately accept and support overstaffing, linking their arguments to the functions of organizational slack (*i.e.* being able to meet future customer demand, to train workers or to ensure good labour relations).

Secondly, our research builds on Nohria and Gulati’s (1997) work, which looks at the optimal level of slack from a quantitative and structural point of view. We show how slack can emerge, persist and be justified in two organizations, despite a context of economic crisis. Moreover, our immersive study provides insight into the concept of organizational slack on two levels: we have not observed the use of slack as a buffer during a time of crisis and we show that slack can be consciously rationalized by managers.

In an environment where overstaffing is viewed as something to avoid at all costs, our case studies legitimize and encourage the practice in other organizations through arguments advanced by managers. Despite interviewing a limited number of actors, we have brought these practices to light by spreading awareness on alternative approaches to overstaffing and slack, and encouraging managers to adopt a different point of view on overstaffing, even during times of economic crisis. It indeed seems reasonable to imagine that our research will have an impact on all sorts of decision-makers and industries – for example, on managers wondering how

<sup>10</sup> At the time of data collection, senior management (except for the Chief Human Resources Officer) had not identified these practices as problematic, which is why potential adjustments, such as changing indicators or offsetting overstaffing costs for operations managers, had not yet been made. Such changes in management practices would not eliminate the tension generated by overstaffing, but only shift it elsewhere. For more details on the tensions between HR and operations managers, see Bernier-Khedache (2019).

to allocate resources after an important slowdown in business activity (*e.g.* due to the Covid-19 pandemic), on public authorities dealing with hospital staffing levels, or on consultants helping with company reorganizations. This study ultimately challenges the myth that the volume of jobs should always be reduced.

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# Story of a gradual decline of maintenance skills in a high-risk organization (1980-2020)

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In industry, maintenance work, which is deemed non-strategic, is widely subcontracted. While these activities are essential to maintaining the reliability of high-risk organisations, the fact that they are subcontracted is frequently blamed for industrial disasters. In the short term, this leads to financial gains, but also to adverse effects, especially in terms of skills. An in-depth, longitudinal, and multi-level case study within the high-risk business line of a major government-owned company enables us to map out the skills-loss process, to identify the factors behind it, and to inform the analysis of the relationship between inter-organisational control mechanisms and the skills that are required to perform the outsourced activities.

Although there is a large body of literature on subcontracting, its issues within so-called high-risk organizations (HROs) have been subject to very few empirical studies. However, it is not unusual to see subcontracting blamed for industrial or rail disasters such as AZF, Lubrizol and Brétigny-sur-Orge. Subcontracting issues are all the more critical in HROs as they involve their responsibility for maintaining plant reliability (Bourrier, 2009). Monitored by external regulatory bodies, they are bound by regulations to monitor and report on subcontracted activities, under pain of penalty. Maintenance activities, which have been widely subcontracted since the 1980s but are essential to maintaining the reliability and safety of plants, are subject to sustained vigilance involving both contractor and subcontractors to ensure the compliance of the operations to be carried out and the preservation of the related skills.

Whilst the literature on inter-organizational control has flagged up different control methods and emphasized their impact on skills, very few empirical studies have provided in-depth analysis. In addition, under the combined effects of the economic crisis, encouragement to preserve production equipment and the increasingly complex nature of socio-technical systems and high-risk activities, the maintenance of industrial facilities takes on a whole new importance. This is the conclusion we have drawn from an in-depth case study on changes to management methods in a high-risk industry which shows, amongst other things, their impact on maintenance skills (Masson, 2019). While the company under review (which we will call Alpha)<sup>1</sup> acknowledges a certain decline in its maintenance skills, there are

differing interpretations as to its causes and effects. How can the decline in maintenance skills in a high-risk company be explained?

To answer this question, we will be taking a comprehensive (Dumez, 2016) and multi-level (Brabet, 1993) approach. To this end, we will go back over the timeline of the facts and the resulting management decisions, and will match them with the related maintenance practices so as to more closely assess the risk factors with regard to skills. After having provided an overview of our framework for analysis, the company, its background and the methodology used, we will report on our empirical study and discuss its results.

## The maintenance outsourcing paradox

Is outsourcing industrial maintenance always compatible with reliability requirements for a high-risk organization? To address this question, we suggest linking three strands of the literature (inter-organizational control, high-risk organizations and maintenance activity).

### Cost reduction vs skills: tensioning of outsourcing control methods

Concurrently with a company's move to refocus on its core activity, the use of subcontracting meets targets in terms of flexibility and cost reduction, and takes a variety of forms such as outsourcing low value-added activities or the use of expertise seen as too expensive to keep in-house. In all cases, the subcontractor requires the instructing party to make management choices that steer the nature of inter-organizational control devices (van der Meer-Kooistra and Vosselman, 2000;

<sup>1</sup> For the purpose of confidentiality.

Nogatchewsky, 2009). Three control patterns enable instructing parties to influence and coordinate the actions of subcontractors without hierarchy (Nogatchewsky, 2002). The market-based pattern (formal control) is grounded in competition between external stakeholders through, (for example) calls for tender. Bureaucratic-based pattern (formal control) is contingent on norms and standards ensuring supervision and assessment of external stakeholders. Trust-based pattern (informal control), which is also known as social-based control, is based on invisible devices (Beaujolin-Bellet and Nogatchewsky, 2005): trust and forging relational norms (*i.e.* common values, shared expectations) between stakeholders (Barthélémy and Donada, 2007). This means that social control is established at micro level and is reliant on interpersonal relations built up over time, and is the “cornerstone of the cooperation process” (Donada and Nogatchewsky, 2006, p. 283) between stakeholders belonging to different organizations. These control patterns are ideal types as, in practice, they are not exclusive and overlap (Nogatchewsky and Donada, 2005) although one of them will be dominant (van der Meer-Kooistra and Vosselman, 2000).

Nevertheless, owing to the financial deepening of businesses, a model characterized by heightened formal control is tending to take hold with many objectives being contracted out, subcontractors competing with each other through increasingly standardized calls for tender and the proceduralization of work. Beaujolin-Bellet and Nogatchewsky (2005) present the impacts of changing to inter-organizational control patterns using a case study of industrial maintenance outsourcing. This change often took place on a continuous basis drawing on opportunities and local relations – fostering the emergence of a social control pattern – which enabled the subcontractors to acquire specific skills and an in-depth knowledge of the instructing party’s facilities, which are guarantees of quality and responsiveness. These skills have cushioned critical situations by compensating the contractor’s shortcomings at no extra cost: Subcontractors are used as providing organisational slack. However, cost streamlining requirements leading to the centralization of procurement decisions have led to a preference for the formal market-based pattern. Whilst this reduced immediate apparent costs, it also had adverse impacts including longer facility outages for maintenance, an increase in emergencies and risks, and problems with managing jobs and skills.

Barthélémy and Donada (2007) draw attention to the “skills/control” relationship as control patterns do not only change on the basis of streamlining costs but also according to the extent of the gap between the skills of the instructing party and those of the subcontractor. This gap opens up when the instructing party no longer carries out the subcontracted activities (van der Meer-Kooistra and Vosselman, 2000). Accordingly, subcontracting maintenance work removes the instructing party’s employees from the facilities and alters their duties from that of “repairers in direct contact with technical equipment” to that of “supervisors [...] tasked with checking the work of others” (Tillement, 2011, p. 124).

As skills are built through action (Dietrich, 1999), they are lost as soon as the activity is no longer practiced (Koenig, 1994; Mazeau, 2001).

As a result, the narrower the skill gap, the more formal control patterns appear appropriate (Barthélémy and Donada, 2007). Conversely, the more it widens, the less the instructing party is able to assess the subcontractors’ work, clearly state their requirements and decide on the best tender. In this context, the authors advocate the use of informal control (trust-based pattern) to reduce this skills gap by forging interpersonal relations to contribute to mutual understanding and learning. To do so, focus should be placed on the design, quality, and permanence of inter-organizational relationships.

### High-risk organizations: The delicate balance of reliability

So called high-risk organizations (aerospace, nuclear, etc.), carrying direct risks for the environment and populations, have been defined in contrast to “classic” ones. Starting in the 1980s, the Berkeley group’s work emphasized the complexity and tension within these organizations: between output targets and safety (Rochlin, 1993), and between centralization and decentralization (Eisenhardt, 1993). This literature also flags up two conditions required to safeguard the reliability<sup>2</sup> of facilities:

- A balance between controlling regulation and autonomous regulation (Reynaud, 1997), based on a view of people and their situational intelligence (Zarifian, 1999) as a factor of reliability.
- The presence of organizational slack where the predominant management methods put a continuous drag on resources (Schulman, 1993), whereas maintaining reliability requires substantial financial resources (Wildavsky, 1991; Weick et al., 1999).

Work on ergonomics emphasizes the positive role of teamwork in safeguarding reliability. If a team is well organized, has experience, targets and a common language, it offers the best response possible to safety issues raised by these systems (De Keyser, 1989). It fosters discussions about business activity, capitalizing on experience, reporting abnormal situations, onboarding and training new members and tacit knowledge transfer. It may also have an adverse effect if it is hampered by organizational changes that promote inward-looking behavior which has an impact on collective due diligence and mutual support (Daniellou *et al.*, 2010).

In the same way as “classic” organizations, these HROs have widely outsourced the maintenance of

<sup>2</sup> Reliability embodies the capacity of a system or equipment item to carry out a required function in given conditions and during a given timespan. It has three features – those of a technical (operating without outages under given conditions of use and for a given timespan), organizational (ability to maintain its performance levels in spite of the presence of risks) and human (capacity of an individual or team to successfully carry out an assignment that must be completed within a given timespan and under set conditions) nature.

their facilities, although subcontracting is deemed to have “a direct effect on safety” (Walter, 2017, p. 397). Ironically, the practice has been scarcely analyzed in light of the risks that it can cause (Le Coze, 2017) e.g. work-related accidents considered to be more frequent, heightened time pressure and loss of skills in the event of staff downsizing. In addition, the increase in the number of companies involved in maintenance activities represents one of the main safety risk factors (de Bovis, 2009): this issue is even more key as socio-technical systems are becoming increasingly complex due to their becoming part of huge mass networks (Veltz, 2000) in which the slightest malfunction can trigger a chain of disruption with repercussions of variable severity. This unquestionably explains the current focus on understanding maintenance activities and the related expertise and skills.

### Maintenance is more complicated than it seems

The purpose of maintenance is the long-term safeguarding or repairs to various equipment items so that they “continue to function like before” (Tillement, 2011, p. 120) and it covers two types of operations: preventive (upkeep, calibration, repairs) and corrective (examining and finding solutions to breakdowns). In a high-risk organization, the primary aim is to avoid malfunctions or breakdowns that would cause a high-risk outage of the facilities. Nevertheless, having been designed as a strategy for avoiding breakdowns, preventive maintenance cannot boast a finished product which means that it is undeniably “invisible”. It is implemented so that “everything continues as if nothing has happened” (Denis and Pontille, 2020, p. 2) and is classified as a “hollow” activity (Boissières, 2003). This explains both why it is seen as a non-strategic activity and why it is considered commonplace especially as it is repetitive work that has to be carried out again and again. From this viewpoint, maintenance seems to be a field for mapped-out and procedure-based activities that merely have to be learned in order to be carried out. This interpretation reduces skills to just the technical aspects of the activity which are listed in various documents and which simply have to be applied (regulations, frameworks, ranges, etc.).

Yet, maintenance encompasses a vast range of tasks (Dant, 2010) which, when analyzed, highlight the site-specific investigation work involved (Vinck, 2019; Denis and Pontille, 2021): inspecting the equipment, searching for and repairing faults, identifying the problem, its cause and putting forward solutions. When viewed this way, it may seem straightforward. However, Hatchuel and Weil (1992) had already stressed the importance and the specific nature of the repairer “knowing how to understand” to solve the problems they are faced with. Knowledge and understanding of the day-to-day functioning of the relevant system does represent a prerequisite for carrying out maintenance work (de Montmollin, 1984; Hatchuel and Weil, 1992; Tillement, 2011). This work requires a broader set of knowledge and expertise than is evident, including different functioning methods, and is not restricted to

applying operating methods to which it is often reduced. This ability to investigate the state of things is developed with professional experience through a “close, physical relationship with the facilities” (Tillement, 2011, p. 120). However, the investigation is not only technical as it also calls for social interaction, especially when the work is outsourced and involves many stakeholders belonging to “separate yet interdependent groups” (*ibid.*, p. 125).

Whilst the literature posits that companies that subcontract part of their activities lose skills, there are few empirical studies that document this process. As a result, we consider it relevant to study it and, thereby, to understand the reasons and implications thereof in a high-risk context.

## Research context and methodology

Alpha is a major state-owned French company with both industrial and commercial activities, and which is undergoing significant changes. We will be focusing on its Production Division, which is tasked with a high-risk activity and which is composed of management at national level and a large number of local production sites. Every 12 to 18 months, the Production Division shuts down its facilities for maintenance work which has been outsourced since the 1980s. The Production Division has built up a substantial network of subcontractors which it structures, coordinates and controls. During these outages, the subcontractors carry out preventive (systematic) maintenance, upstream of any breakdown or malfunctioning, to verify the working order of the facilities, compliance with safety standards and to mitigate the risks of problems occurring. There are around 20,000 external participants working for 600 subcontracting companies and representing a large number of disciplines (welding, plumbing, scaffolding, etc.). They travel from site to site to carry out the required work and this doubles, or even triples, the on-site headcount.

The option of outsourcing maintenance goes hand in hand with the Production Division refocusing on its core activity, namely energy generation. The rationale for this choice is a cost-cutting drive which has been stepped up by the company being privatized. Whilst opening up to competition has caused Alpha to lose a large number of customers, the Production Division is confronted with an increase in costs which contributes to Alpha’s financial debt: investments are required in light of the increase in maintenance activities due to the ageing of the facilities and also a drive to extend their lifespan. Use of subcontractors is on the rise whereas deadlines and quality requirements have remained the same and the HR department is striving to reduce staff numbers. Moreover, since 2010, the Production Division has been hit by the departure of the generation of “builders”, referring to the employees of instructing parties and subcontractors who were involved in building and commissioning the production sites. This has led to major generational renewal<sup>3</sup> which raises

<sup>3</sup> In 2014, 40% of staff had less than six years’ experience.



Alpha's national level	Production Division production site no. 1	Production Division production site no. 2
<p>Divisions/departments involved in managing subcontractors.</p> <p>14 semi-structured interviews (1-2 hrs in length) with:</p> <ul style="list-style-type: none"> <li>• the Production Division's national level (management team, technical system designers and managers overseeing the work of local stakeholders): senior executives and their team members</li> <li>• the manager of the Technical Department, engineers/designers of maintenance activity management systems (technical management), manager of the department tasked with industrial relations, technical-economic engineers and expert advisers in the industrial relations team</li> <li>• the Procurement Department: the department's manager, procurement strategy managers</li> </ul>	<p>Sites selected on the basis of their varying ranking in the subcontractor satisfaction survey (the first and the last).</p> <p>39 semi-structured interviews (1-2 hrs in length) were conducted with:</p> <ul style="list-style-type: none"> <li>• the site's management (Production Division): site manager, industrial policy team, contract managers, HR team</li> <li>• the line management (Production Division): managers of the maintenance outage projects, the planning department, the Methods Department, and the business lines (plumbing, boilermaking, etc.)</li> <li>• stakeholders in the field, technicians (Production Division): project managers, oversight managers (junior and senior)<sup>4</sup></li> <li>• subcontractor supervisors and operators</li> </ul>	

Table. Investigated fields.

skills-related issues. Our research, covering the period from 2015 to 2019, has been carried out against this backdrop which is conducive to examining the loss of skills in a high-risk organization.

We considered that a case study (Dumez, 2013) was the most appropriate research strategy for a comprehensive approach (Dumez, 2016) to Alpha's management choices amid significant changes and their repercussions with regard to skills. Drawing up a timeline (Dumez, 2013) means that we can trace the long and complicated skills-loss process and pinpoint the main factors that contributed to this. A multi-level approach (Brabet, 1993) helps understand the different viewpoints concerning the maintenance work and the skills it requires: between stakeholders at headquarters and at the sites, both former and new, instructing parties and subcontractors. Three main "fields" were investigated.

This data was enhanced by examining internal and external documents which was carried out in an iterative manner, with the researchers constantly going back and forth between the field and the theoretical frameworks used. The results were presented to the Production Division's local stakeholders<sup>5</sup>, who confirmed their relevance, thus providing a sort of "in-house" validation.

## Story of a proven loss of maintenance skills

The hypothesis of a loss of maintenance skills clearly emerges from the statements of the interviewees. They

<sup>4</sup> "Senior" stakeholders in the field belong to the "builders" generation

<sup>5</sup> Alpha did not authorize the presentation to subcontractors.

see it as a logical consequence of the decision to outsource:

"Once activities are outsourced, there's no doubt that the subcontractors are better than us" (Production Division line management, site).

However, this does not explain why this loss of skills by the instructing party becomes critical, nor why it also has an impact on the subcontractors. To address these questions, we will trace the timeline of maintenance organization and management practices.

## From the 1980s to the 2000s: Maintaining maintenance skills

Prior to the 1980s, the Production Division was responsible for the maintenance of its facilities and hired technicians for this work. Years of practice combined with training enabled these technicians to acquire strong technical skills and in-depth knowledge of the facilities and their constraints, in light of the safety requirements of a high-risk activity. During the 1980s, the expansion of subcontracting altered these technicians' responsibilities: they became Project Managers and Oversight Managers. Project Managers organize and manage the outsourced work with the relevant external and internal stakeholders. In conjunction with the line management for the many subcontractors, they are responsible for their results. Whilst Project Managers must be familiar with the technical work to be carried out, the skills required for their positions are primarily interpersonal and organizational in nature: thorough knowledge of the site and its operating methods. Oversight Managers are responsible for ensuring the compliance of subcontracted activities with the specifications and for checking that

files are in line with regulations. Since 1984, an order<sup>6</sup> has obliged Alpha to oversee the subcontracted activities itself. Whilst they no longer carry out maintenance work themselves, the Project Managers and Oversight Managers have kept their skills and know-how over time. There are two main reasons for this:

- On the one hand, they are still informally involved in subcontracted activities thereby maintaining their technical skills and transferring their knowledge of the facilities to the subcontractors' operators. However, the Act of 12 July 1990<sup>7</sup> for preventing any improper subcontracting ("délit de marchandage") requires subcontractor companies to oversee their employees themselves. Mixed teams became illegal and the Project Managers and Oversight Managers have been replaced by subcontractor supervisors. Nevertheless, they do forge close relations with the latter in order to provide them with the required information and to inform them of the Production Division's demands.
- On the other hand, the stability of subcontractor companies, due to a lack of competition, fosters a trust-based relationship between the Production Division and its subcontractors. A report from Alpha's R&D department (2004) confirmed that it is in the Oversight Managers' interest to adjust formal rules together with subcontractors so as to avoid situations of work-to-rule and the withholding of information. To understand their headroom with regard to the guidelines, the Oversight Managers continued, despite the ban, to assume their previous responsibilities in order to "fine tune their knowledge and technical command of the activities and systems to be overseen", seen as "the only guarantee of a fair assessment of subcontractors' work" (Alpha R&D Report, 2004).

Trust-based relations with stable partners and technical practice prevented the emergence of a skills differential between instructing parties and subcontractors. Consequently, for twenty years, outsourcing did not cause any major problems.

### 2000s: Management choices and generational renewal accelerates the loss of skills

The privatization process, which began in 2001, resulted in budgetary cuts to attract new shareholders<sup>8</sup>. Finance-related decisions led to a reduction in payroll expenses and training costs. Consequently, in 2005, the Production Division's national level elected to eliminate the "pépinières" ("incubators"), a system for providing support to new recruits prior to taking up their position which was conducive to transferring knowledge and know-how. It was only after 2010, during a huge generational renewal, that the company became aware of the impact of this decision.

<sup>6</sup> Which we will not identify for reasons of confidentiality.

<sup>7</sup> Act no. 90-613 "promoting stable employment by adapting arrangements for temporary contracts".

<sup>8</sup> The government nevertheless remained the majority shareholder.

"There was huge pressure to reduce resources and budgets. The 'pépinières' were phased out at the same time as the renewal of skills was taking place. Now, everyone realizes that this was a mistake. People who worked in the workshops, who still knew how to carry out maintenance work, retired and weren't replaced" (Senior Executive, Production Division, National Level).

When the generation of "builders" retired, the organization lost the technical expertise and the control over the functioning of the facilities that this generation acquired thanks to their involvement in the construction of the sites.

In turn and over time, the Production Division's initial management choices proved to be detrimental to maintaining skills. Starting in the 1980s, the Production Division had opted to entrust the majority of "case 1" work to subcontractors (the subcontractor carries out the work according to its documents, its operating methods, examines the discrepancies and puts forward solutions) rather than "case 2" work (the Production Division's Methods Department prepares the files and procedures, examines the discrepancies and puts forward solutions). This decision gradually moved the Production Division's stakeholders away from maintenance activities:

"Case 1 is very damaging for skills. A hydraulic test takes 35 days. The Project Manager stays in their office and monitors the schedule but, after three years, they no longer know how to carry out a hydraulic test. Before, these tests were carried out by our teams. It wasn't a problem; we knew what to do. But now, it's a real headache" (Senior Executive, Production Division, National Level).

2010 saw the start of financial problems for Alpha and the introduction of a severe cost-cutting policy. As the "builders" retired, the Production Division focused its HR strategy on cutting staff numbers with a target of "200 employees fewer per year" (HR Support, Production Division, site). Technicians were significantly affected: deferred hiring, periods for transferring skills between outgoing and incoming staff shortened or even cancelled:

"For fifteen years the Production Division didn't hire and then, suddenly, it began recruiting again. But senior staff left and juniors arrived without there being enough time to pass on know-how" (Senior Oversight Manager, Production Division, Plant).

Against this backdrop, new Project Managers and Oversight Managers arrived at the same time as changes to inter-organizational control patterns.

### 2010s: A change in control patterns accelerates the loss of maintenance skills

Alpha's financial difficulties led the Production Division to recast management of the instructing party/subcontractor relationship in order to make savings. Two decisions overhauled inter-organizational control patterns, and we will highlight their impact on the skills of those working on the field.

### **Selection of subcontractors becomes the responsibility of the Procurement Department, and market-based pattern strengthens**

The combination of bureaucratic and social-based patterns which had governed instructing party/subcontractor relationships was replaced by a combination of market and bureaucratic-based patterns. Selecting subcontractors, which had previously been carried out at local level, was centralized in the Procurement Department – a practice which is, at the end of the day, widespread in the industry. Being centered more on cost-cutting than on fostering interpersonal relations with subcontractors, the business line approach was replaced by a financial one:

“The Procurement Department is separate from the business lines and is only driven by procurement rules and financial performance levels” (Executive, Procurement Department).

This also represented a breakaway from the policy of the Production Division which had elected to restrict its pool of certified subcontractors<sup>9</sup>, as it considered that, over time, working with the same subcontractor guarantees quality of service, encourages shared knowledge of operating methods and the forging of relational standards conducive to asserting social control to mitigate the bureaucratic control applied at local level. Where the Production Division had chosen weaken the market-based pattern, the Procurement Department fostered competition between subcontractors through invitations to tender in order to force them to lower their rates with an eye to offsetting the increase in the overall volume of maintenance work. This heightened market-based pattern compounded the more regular turnover of subcontracting companies which, on each occasion, led to the loss of skills acquired during performance of the contract:

“A subcontractor company that holds the procurement contract for five years upsells, invests in its staff and therefore increases its rates. For the next invitation to tender, another company wants to win the contract and undercut prices, and it ends up being successful on financial terms but then we have to start all over again from a technical standpoint” (Project Manager, Production Division, Plant).

### **The management contract strengthens bureaucratic-based pattern**

Whilst the market-based devices take precedence over trust-based pattern at the selection stage, bureaucratic-based devices become more robust during the operational stage with the implementation of contract management. This is seen as a measure for improving productivity and calls for strict application of contractual penalties as soon as subcontractors fail to comply with an obligation (deadlines, quality, etc.). While these clauses were already in the contracts, they were not often applied as local stakeholders’ “best interest was that relations were as amicable as possible” (Plant Manager, Production Division) and disputes were indeed settled amicably on site. Contract management

<sup>9</sup> To reply to calls for tender, subcontracting companies must submit to classification audits on topics that are predominantly technical and organizational. If they pass, they join a pool of companies that may be approached during the invitations to tender.

“sets the record straight” (Executive, Production Division, National Level). However, making the contract central to the relationship “changes relations” between local stakeholders (Senior Executive, Production Division, National Level) and further undermines social-based pattern. Application of penalties makes inter-organizational relations more bureaucratic and inflexible, weakens inter-personal relations between Production Division stakeholders in the field and subcontractors, and has an impact on their cooperation and the opportunities for the joint inter-organizational regulation required for exercising social control:

“Quality defects are dealt with by the site’s management which takes a more contractual approach and this creates tension. If everything in the Production Division was perfect then we could criticize the subcontractors. But the Production Division is far from perfect. However, when there’s a quality defect, we tell them: “It’s your fault, pay up” (Production Division line management, Plant).

This contractual approach alters the subcontractors’ work. With their superiors’ agreement, they no longer take the initiative for fear of their company having to pay financial penalties:

“An initiative can be expensive, very expensive!” (Subcontractor’s supervisor).

This heightened bureaucratic-based pattern therefore contributes to the “disinvolvement” of subcontractors as they no longer put forward solutions to identified problems and leave this part of the investigation to the instructing party as part of its regulation of control. The issue at hand is whether or not the latter still has the skills required to solve the problems identified by subcontractors.

### **The bureaucratic-based pattern spiral: Administrative supervision and a loss of legitimacy for Oversight Managers**

Whilst discussions between the Production Division’s stakeholders in the field and the subcontractors encourage mutual knowledge-sharing and joint regulation conducive to safeguarding reliability, the junior Oversight Managers’ total lack of practical experience means that they simply stick to carrying out formal checks of compliance with guidelines:

“It’s pretty simple to carry out an activity. You take your file, read it, respect the range specified and tick off what you’ve done. If you do that then no one will see anything in particular. You take the file, read it, watch what the subcontractor’s operator does and, as they do it out of habit, they may not read the file; there’s something that is written and we don’t see them do it. So, we tell them “I didn’t see you do that”. And we criticize them for not having read it. We don’t take them by surprise, we explain that we want to see them do it word for word” (Junior Oversight Manager, Production Division, Plant).

This totally administrative view of supervision carries non-negligible risks of poor workmanship and a lack of control. It reduces the work and its supervision to a list of tasks to be ticked off, to the detriment of actual circumstances and their contingencies:

“If I assemble something the wrong way round, at the moment, the Oversight Manager isn’t aware, they don’t see that I’ve



assembled it the wrong way round but will penalize me for a mistake in the file" (Subcontractor's operator).

Mistakes that are detected too late may have adverse effects on the safety of the facilities, the length of outages, or cause breakdowns that the Production Division strives to avoid.

The Production Division also looks to avoid mixed groups both with an eye to complying with regulations and with respect to liability in the event of a quality defect:

"Today the approach is one of background supervision as we attempt to move away from supervision in the vein of "I'll give you a hand, pass me the spanner" (Senior Executive, Production Division, Plant).

As junior Oversight Managers lack practical experience and knowledge of what the work actually involves, they no longer have the skills necessary to carry out control work:

"We are not competent enough to criticize subcontractors' work and this causes problems. The subcontractors' work should not only be assessed in light of regulations or guidelines, you also need knowledge of the field. This is a problem for our people as they are increasingly less knowledgeable on this matter" (Production Division line management, Plant).

Another adverse effect of the loss of skills by the Production Division's stakeholders in the field is that subcontractors no longer consider the junior Oversight Managers to be competent:

"It's hard to tell someone that "you have to do it like that" if the person has never done it themselves. You need a certain legitimacy to make demands before being able to say "it has to be done by such and such a time". You have to understand whether its achievable or not" (Production Division line management, Plant).

This means that this loss of skills also has an impact on the planning of activities by the Project Managers:

"This is reflected by a lack of knowledge about intervention times. If you don't do it, you don't know how much time is needed for an intervention. This is a fundamental of production management. This skill has very often been lost" (Executive, Production Division, National Level).

Underestimating these requirements has a direct impact on planning and causes greater time pressure which hampers subcontractors' work. This knowledge, which is acquired with experience, contributes to the instructing party's organizational skills. Failure to manage these timeframes compromises coordination of maintenance operations. Having become aware of these problems, in 2015, the Production Division's national level decided to outsource part of this organization work, a decision which, for some, accelerated the loss of technical skills. What is at stake is "the Production Division's ability to work effectively with subcontractors" (Executive, Production Division, National Level).

## Discussion-Conclusion

In examining changes to maintenance practices, we can see a continuous increase in skills-related issues

and maintenance costs. Whilst the Production Division is continuously striving to cut costs, we can question the logic of decisions "whereby the originators act consistently and intensively against the goals they have set themselves" (Morel, 2002, p. 13). Our empirical study backs up the hypothesis flagged up by the literature of the instructing party's loss of skills when they no longer carry out the activity that they outsource. It demonstrates the effectiveness of the social-based pattern put in place by the "builders" at micro level but also its vulnerability and the harmful impact of its weakening as a result of the strengthening of formal control. It also highlights the importance of collective work and inter-organizational cooperation for maintaining and expanding maintenance skills both for in-house stakeholders and subcontractors. Our study therefore confirms the importance of the social-based pattern when the gap between the skills of the instructing party and those of the subcontractors widens. In particular, it shows how an instructing party whose skills are declining weakens the autonomous and joint regulation which the literature on high-risk organizations indicates as being required.

This leads to a certain number of adverse effects: the Production Division's stakeholders in the field not only lose mastery of technical tasks but are no longer able to assess the subcontractors' abilities in this respect; they fail to notice mistakes by simply focusing on administrative supervision of the work. This means that their loss of skills bolsters formal control which in turn has an impact on the subcontractors' maintenance skills. Lastly, the requisite conditions for safeguarding the reliability of HROs are not met as there is an imbalance in favor of the control regulation and centralization, a loss of organizational slack to which subcontractors contributed, and an erosion of inter-organizational collectives. At the end of the day, in a high-risk context, are budgetary streamlining and subcontracting compatible in light of the control patterns that they require? One drives towards formal control patterns whilst the other requires informal control pattern to be maintained in circumstances where the loss of skills can lead to disaster. The case study highlights how decisions taken to address financial difficulties may have an in-depth effect on the skills needed to maintain the safety of facilities.

Whilst outsourcing is not called into question by the company's stakeholders, the reasons for the loss of skills nevertheless causes controversy in-house. In the divisions/departments, some attribute responsibility for the problems encountered to subcontractors (management difficulties, lack of training for new arrivals). It is true that educational establishments no longer teach the Production Division's technologies which date back to the 1960s and 1970s. Of course, responsibility can be placed on the shoulders of subcontractors tasked with training their junior staff but market-based pattern hardly encourages them to invest in such a specific asset owing to the uncertainty surrounding future contracts. It should be reiterated that the technical skills required can only be acquired by using these technologies. Others (usually those with the most seniority) blame the decline in the Oversight Managers' maintenance skills and its impact on their ability to carry out control duties. These diverging



viewpoints perfectly reflect the complexity of the skills-loss phenomenon.

Consequently, conceptions of work and organizations clash and reveal opposing cultures, confronted with a major challenge for HROs. This is another strength of our study: giving visibility to the ways in which two successive generations work in the same company, and highlighting their opposition by underlining:

- On the one hand, the connection between a robust business line culture, supporting the development of tacit know-how and social control conducive to learning “on the job” and, more broadly, to inter-organizational cooperation. In this context, maintenance appears as a group activity and not as a turnkey service, involving shared responsibility and organizational learning fostering skills development.
- On the other hand, the connection between a financial logic, with concerns about cost-cutting, the standardization and harmonization of practices, and the development of a market-based pattern, in parallel with the bolstering of bureaucratic-based pattern which is detrimental to the involvement of subcontractors. The company’s standardization and bureaucratization go against the humanist culture of the “builders”. The dominance of prices in the selection process tends to disqualify subcontractors that have demonstrated their know-how, and this prevents experience acquired “on the job” from being capitalized on. According to the Production Division’s stakeholders (local level), this side-lining of business line expertise in favor of cost cutting contributes to the loss of skills of the instructing party and the subcontractors which represents an undeniable risk of quality defects.

Nevertheless, no major incident has contributed to establishing a loss of skills which made it all the more difficult for management to accept it. By plotting out the timeline, we have been able to fine tune analysis of the process by which skills declined. It emphasizes the length of time, due to the joint inter-organizational regulation methods implemented by the “builders”, and the delaying effects of management decisions which, over time, proved to be detrimental to knowledge transfer. This loss of skills was therefore gradual which makes it barely noticeable in the short term and hampers the company’s awareness of the risks it carries.

We highlighted a whole range of factors that have contributed to the slow decline in skills, going so far as to question the organizational competence of the instructing party. The latter’s loss of skills combined with the financial difficulties ultimately led to a destructive spiral from which the company has trouble escaping. However, the company is now aware of the scale of its loss of know-how. In this respect, our study flags up the interest in assessing the relevance of the inter-organizational control patterns adopted in light of their impact on skills.

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# Of chips and men: When working in Industry 4.0 is more human than expected

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In order to address the challenges of efficiency and manufacturing quality, the high levels of automation and data integration that characterize Industry 4.0 make it possible to produce customized runs at a similar cost to mass production, which leads to the creation of vibrant and complex work situations. In “flow” industries, such as microelectronics, very real human work becomes less visible as it only occurs in the event of a flow or process interruption. But what exactly are the consequences of this automation, pushed to its maximum, on the work and the skills required for production operators? This paper is based on an industrial case study, where the search for high performance levels and the increase in automation lead to increased monitoring of anomalies. The theoretical framework chosen is that of invisible work and its threefold experience (Gomez, 2013), which allows us to discover a change in work that is not really considered by the official organization. Thanks to a qualitative approach combining direct observation and semi-structured interviews, this research reveals that the work experience is marked by a ballooning objective dimension, a far cry from the most frequent, flattering presentations of Industry 4.0. A collective, non-official component is still necessary, with many interactions. Lastly, the subjective experience reveals many areas of tension. Thus, “4.0” work, even if it is more automated, turns out to be much more human than expected.

## Introduction

“A vision of the future in which we somehow take leave of material reality and glide about in a pure information economy” (Crawford, 2010, p. 9).

Smart factory, industry of the future, and digital business are some of the many terms used to refer to the concept of “Industry 4.0”, an expression first coined in Germany in 2011. This industrial revolution, defined by the European Commission as “the end-to-end digitization of all physical assets and integration into digital ecosystems with value chain partners” (2020), is often compared to the revolution that took place in the 19<sup>th</sup> century given the rapid pace and scale of the transformation under way. Firms are in this respect expected to switch from mass automation to optimized automation, and from a digitalization of processes to advanced information technology (Gaudron, 2017).

For ten or so years, various publications dedicated to this field have – besides feeding the hype – attempted to give an insight into Industry 4.0 with regard to its actual dimensions and the many issues it raises. To be able to create customized runs at a similar cost to mass production runs, firms need to overcome a number of

obstacles: combining top-down planning and analysis of reportable and multi-form data throughout the “automation pyramid” (BPI France, 2015); ensure the successful functioning of “end-to-end” processes so that the entire production chain has access to authoritative information in a homogeneous environment; and implement an adapted supply chain that departs from industrial mass production culture.

However, this does not mean that the essentially human-centric challenge of the transition to Industry 4.0 is of least concern. As demonstrated by Durand *et al.* (2014), this development in industrial information systems has resulted in a massive increase in management tasks, information overload, more stringent requirements and an erosion of interpersonal relationships. As has been observed in certain sectors such as aerospace, petrochemicals and nuclear power, complex work situations have emerged that can be deemed “dynamic-based” since they are beset by constant change, tasks with multiple focus areas, and work dynamics that alternate between routine and unforeseen events (Amalberti, 2001).

And yet, as Barcellini has noted (2019), these work situations continue to be generally given little

consideration in relation to Industry 4.0, since human-centric factors are barely factored into this revolution. Galindo *et al.* (2019) recently stressed the difficulties of bringing the interests of stakeholders in this process into line; Compan, Cutarel, Brissaud, and Rix-Lièvre (2021) have begun to shed light on professional dilemmas, the cognitive and social facets of human-machine interaction, and an emerging insufficient capacity. However, empirical approaches relating to ongoing changes and their effects are lacking (Magone and Mazati, 2019); a forward-looking approach to Industry 4.0 on the labour and human resources front (Bootz *et al.*, 2022) still needs to be further developed, and the state of knowledge remains patchy.

As a result, this paper seeks to help ensure improved human resource management within the context of Industry 4.0 by factoring in the actual work of the operators concerned. What consequences do automation pushed to its limit and digital integration have on human work and the production operator profession? Following an overview of the state of knowledge and the issue accompanied by a conceptual framework, we will present a case study conducted in the microelectronics sector. This case study will enable us to take on board the experiences of operators and the need for change in human resource management: the work of Industry 4.0, despite being more automated, has turned out to be much more human than expected.

## Industry 4.0 as a process requires in-the-field investigation, particularly by examining work experiences

Industry 4.0 should be understood as a process rather than a fixed concept. While the available literature flags up some of the major challenges it poses for work organization, it also encourages a better understanding of work experiences to gain an insight into how the profession of production operators is changing.

### Industry 4.0, a concept with many definitions

From the outset, it is not easy or quick to define Industry 4.0. Table 1 below lists some of the main definitions that have been proposed.

Based on these various sources, Industry 4.0 is not limited to the scope of plants, but covers the entire value chain in which it is incorporated. An ongoing process which is not set in stone, it creates, by means of automation and computerization implemented to the greatest extent possible, complex work environments combining a streamlined and fluidity-focused approach. Remote real-time access to multi-form data (production and control data) has resulted in a new form of human-machine interface. In this respect, we suggest including the following information in the definition of

Authors	Industry of the future
Brynjolfsson & McAfee (2014)	Fusion of the Internet and factories enabling multi-sectoral connection.
Themeco (2016)	Change in the organization of work, practices, capacities and relations creating opportunities for social transformation in working relations.
Lu (2017)	Interconnection and computerization in traditional industry, relating to the principles of interoperability, virtualization, decentralization, synchronization, modular design and a service-centric approach.
Dachs <i>et al.</i> (2019)	Components and machines communicate and co-ordinate their operations in factories and (global) value chains.
European Commission (2020)	The end-to-end digitization of all physical assets and integration into digital ecosystems with value chain partners.
Marnewick & Marnewick (2019)	Integration of various technologies, enabling ecosystems to operate smartly and independently, decentralize plants and incorporate products and services.
Couzineau-Zegwaard & Meier (2020)	Real-time access to all information in the value creation process, factoring in the needs of suppliers and customers through interface between humans and machines within a cyber-physical system.

Table 1: Some definitions for Industry 4.0.



Industry 4.0: Industry 4.0 is not a state but a process of real-time interface between various production systems, encouraging instant discussions and data exchanges, and as a result bolstering the human-machine-product three-way relationship.

### Some major challenges of Industry 4.0 have been identified for work organization

In the 1980s, Boyer (1986) referred to a process of abstraction of implicit work, which in his opinion is the result of technological changes. These days we are witnessing an expansion of “immaterial and cognitive” work (Barcellini, 2019). Within this context the available literature points out three issues: a new distribution of labor triggering a demand for new skills; teams being replaced by cooperation networks; and heightened risk management.

Firstly, the transition to Industry 4.0, like any technological change (Coron & Gilbert, 2019), is not merely a change in processes or technical purpose: It introduces an overhaul of structures and shifts the workload between operator and machine, all under more open and interconnected organization. As Romero *et al.* (2016) posited, we are bearing witness to an exponential increase in human-machine interactions, requiring new physical and cognitive resources. This “extended automation”, a term coined by Kohler & Weisz (2021), will naturally wipe out certain job roles, but is also dependent on new skills being developed: “The 4.0 worker must be able to interact with all of the company’s lines of business, understand their challenges and constraints, and know how to work collectively to achieve continuous improvement and problem solving” (Kohler & Weisz, 2021, p. 19). In the view of Hecklau *et al.* (2016), the competencies required are therefore not of a purely technical (understanding new processes) and methodological (problem solving) nature, but also are personal and social in nature: the ability to adapt when working under pressure, communicate and cooperate.

Secondly, work groups deteriorate amid increasing automation and digitalization. Caroly (2016, p. 101) stresses that in work groups, “the rules of professions and work quality criteria are shared [...] on the basis of recognizing competencies, trust and discussions on values. The vitality of a group can be gauged by the extent to which such rules are reworked”. These work groups need time to adopt and internalize new techniques, but unfortunately little time is provided for highly regulated and automated activities (Clot & Jouanneaux, 2002). To address these “dynamic and complex” situations (Clot, 2006), work cooperation social networks are taking the place of groups. According to Gibson and Earley (2007), these networks solve problems and resolve anomalies through accumulation (assembly of information), interaction (exchange of information), examination (negotiation of meaning) and accommodation (use of information in performance). The emerging architecture of organization breaks down from a value chain to a constellation of archipelagos, shifting from a pyramid to a rhizome (Kohler & Weisz, 2021).

Thirdly, risks, which have always been a part of the industrial sector, are not eliminated by the technological developments currently taking place but are in fact being managed more intensively. Admittedly the role of the production operator has certainly always been to handle risks through their ability to solve problems with “inaccurate and uncertain information” (Benkhanouche, 1996, p. 9). However, faced with these dynamic environments, operators have to contend with what Amalberti (2006) calls “a largely implicit continuum”, and must ensure a more complicated trade-off between restrictions and cognitive resources. They have to exercise judgement, their inductive reasoning, as well as their ability to improvise (Negri & Vercellone, 2008). The etymology of “improvise” is to act outside the normal course of time, but time constraints loom large over automated activities. Galindo *et al.* (2019) and Bennis (2021) even refer to the concept of “ambidexterity”, a requisite quality for operators who must harness existing skills while also exploring new ones.

### Issue overview and conceptual framework: the changing face of the operator profession needs to be analyzed by examining work experiences

A new shift in labor distribution characterized by closer human-machine interaction, a deterioration of work groups, increased work in networks and greater cognition required to handle anomalies are all changes highlighted in this literature for their inevitable impact on those who play a central role in the workshop, namely operators. This section will examine how automation in Industry 4.0 and in particular the increasing need for anomaly monitoring is changing the profession of production operator.

For production operators, despite the array of assistive and predictive technologies available, the “industry of the future” is not spared from unforeseen events. As activities become increasingly complex, the sheer number of players and a “requirement for increasing precision” require more complex monitoring work. Taking the analysis conducted by Amalberti (2001), it can be said that there is a clash between two types of monitoring (the reason behind the compromise mechanism): one covering the conducting of the physical process and the other covering the application of cognitive abilities. Faced with optimization that is at times inflexible, operators are required to ensure a trade-off between the restrictions in this situation and their own cognitive abilities in order to keep “humans in the loop” (Amalberti, 1994, p. 77).

The conceptual framework chosen by us to closely observe and analyze the activities carried out by operators uses the definition of « métier » (“profession” in English) determined by Clot (2007): the combination of personal, interpersonal, transpersonal and impersonal elements. So that this definition can be operationalized to a greater extent in the field, we will use the analytical framework provided by Gomez (2013) which incorporates this definition. According to Gomez, economic shifts currently underway have pushed managers to increasingly focus less on the content of work, making it in a sense invisible in the information

systems developed, resulting in a widening gulf between managers and operators. Industry 4.0 operators are affected by tensions caused by a multifaceted work experience, in which objective, collective and subjective dimensions intermingle. This section will examine the consequences of a high level of automation on the objective dimension of work, whether collective work experience is still necessary, and what will happen to the subjective dimension of work.

## Case study: a microelectronics industry with increasing automation

The basis of this section is a case study on an industrial group using a two-step qualitative methodology, enabling us to observe the work of operators who are central to the production process.

### Overview of industrial case study

The business is part of the semi-conductor market, a fiercely competitive sector for a small number of global leaders, and notably has a plant to which a major R&D center is attached. As a diversified supplier of integrated devices, the business manufactures chips – semi-conductors – using 300 mm silicon wafers. The plant floor space has an ISO 04 cleanliness level, contains ten workshops, and is divided into four departments containing one hundred or so pieces of equipment. With a matrix arrangement, the plant has a product layout servicing various sectors such as the automotive,

telecommunications and aerospace industries. To meet customers' increasingly diversified demands, the industrial manufacturing processes have been progressively automated and enhanced with new digital tools over the past twenty years as shown in Figure 1. For example, the basic system used to select batches of wafers was first upgraded with a semi-automated system in the 2000s, and subsequently with automated transportation and batch loading, and then with a batch classification system. During the observation period, automation was in its fifth stage, which entails the use of a digital tool for monitoring assistance; management is even envisaging a sixth and final stage that would involve outsourcing specialized operators for monitoring anomalies, in a dedicated area located away from the cleanroom.

The semi-conductor manufacturing process is based on a series of successive stages known as operations. The main process involves exposing the resin-coated silicon surface to a laser source using photomasks (reticles). In doing this, additional layers can be built up, and the active areas of transistors can be created. The following stage is called metallization, which involves applying layers of aluminum or copper connections to link the transistors together. The manufacturing process can last several weeks and require up to 600 stages that are front-end (manufacture of components, production of transistors through doping) or back-end (finishing work on transistors, interconnections). About fifty photomasks are usually needed to make just one integrated circuit. The semiconductors are put in their packages at other industrial sites.

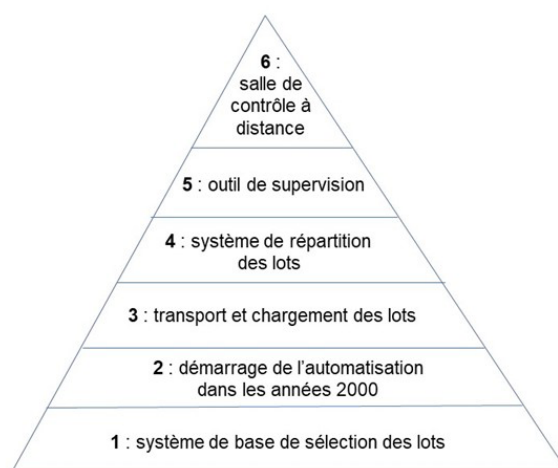


Figure 1: The automation pyramid within the plant.

FR	EN
6 : salle de contrôle à distance	6: remote control room
5 : outil de supervision	5: monitoring tool
4 : système de répartition des lots	4: batch classification
3 : transport et chargement des lots	3: batch transport and loading
2 : démarrage de l'automatisation dans les années 2000	2: uptake of automation in the 2000s
1 : système de base de sélection des lots	1: basic batch selection system

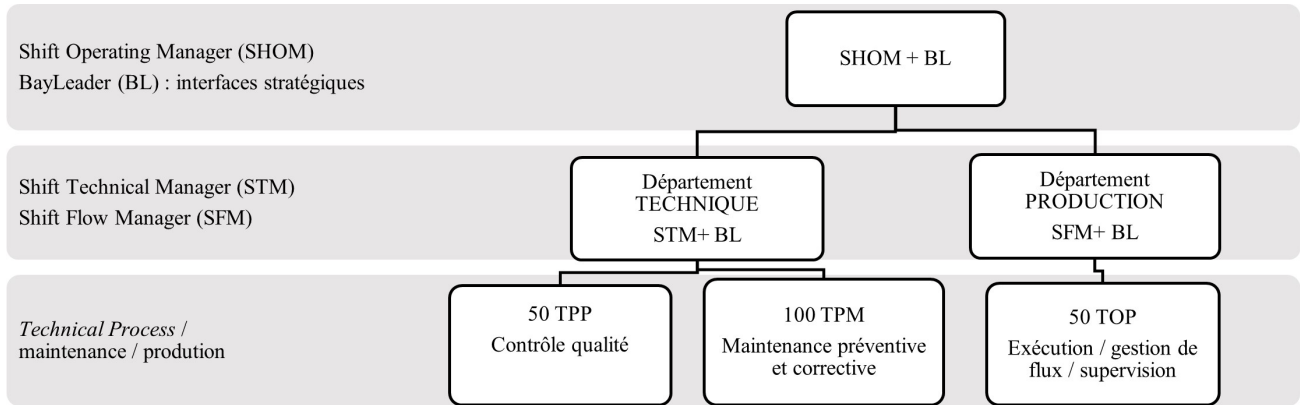


Figure 2: The plant's organizational chart.

FR	EN
Interfaces stratégiques	Strategic interfaces
Département TECHNIQUE	TECHNICAL department
Département PRODUCTION	PRODUCTION department
Contrôle qualité	Quality control
Maintenance préventive et corrective	Preventive and corrective maintenance
Exécution / gestion de flux / supervision	Implementation/flow management/ monitoring

Together with machines operating at maximum power, workers classified under three profession categories (manufacturing/maintenance/quality) – split into five teams working in shifts – manufacture nearly 75 million chips per month, seven days a week. Figure 2 shows the plant's organization chart. The “TOP” – the area of focus for this section – are, in the business's parlance, “production technicians/operators”, responsible for implementation, management of flows and monitoring, but hereinafter they will be referred to as “operators”.

### A two-step qualitative methodology

The industrial site occasionally sustains productivity losses affecting batches and equipment, and the business's management has noted an increase in process times and a reduction in use time – which they deem to be “anomalies”. However, the task of operators in the plant is precisely to ensure that the manufacturing process is productive, available and reliable. Therefore, performance is dependent on “the operator's ability to not interrupt the flow of whatever determines the financial flow” (Vatin & Rot, 2012, p. 2). In this respect, management wants to shift certain operators to overseeing anomalies and flow of processes in an attempt to improve the handling of malfunctions and unforeseen events.

This was the context in which we asked to conduct a study, which the business's management saw as an opportunity to gain more insight into the challenges and conditions of success behind this refocusing. We agreed that this study would not be action research, but rather collaborative research for which the cleanroom would be accessible to us provided we sent regular reports to management. We opted for a qualitative

approach to understand the “why and how” of events by studying tangible situations (Wacheux, referenced by Dumez, 2021). We adopted the recommendation of Detchessahar (referenced by Journé, 2005) to opt for real-time observation that can help understand organizational and strategic aspects which are evident from hierarchical relationships, management tools and procedures, and also within teams.

Our on-site investigation took place between February and April 2021, and sought to examine the actual activities carried out by operators in the cleanroom, and to gather information on the work experiences of these operators in the wake of recent steps taken by the business to advance the Industry 4.0 process. It had two distinct stages: (i) from February to March 2021, non-participatory observation of 33 individuals from three teams working night and day shifts was conducted, and we carried out this work in the cleanroom; (ii) from March to April 2021, we conducted a series of 33 semi-structured interviews. The interview guide used covered the job descriptions, the work environment, interactions and relationships within teams, unforeseen events and the model operator profile, as well as the perceived benefits/risks of automation and remote work carried out by machines. We then transcribed and analyzed each and every observation, staying close to the central concept by recording comments to the letter, counting the number of frequency of observations, and classifying them by sub-topic (as per the analytic framework) or by adopting Gomez's segmentation approach. We supplemented these observations by examining in-house documents on the plant's industrial organization. Lastly, we had the opportunity to report the initial results both within our research team and to the plant's managers.

## Operators at the heart of the production process

While an outside observer would expect the cleanroom to be a world stripped of human qualities populated primarily with robots, it is actually a bustling hive. While robots are installed on the ceiling, workers in coveralls wearing masks monitor the wafers every step of the way and work hurriedly together to ensure as many activations as possible. At first sight, it may seem that the work done in the cleanroom by these operators is invisible. With their work leaving little more than a shadow of a trace, the operators produce a product which cannot be seen, all the while using decision-making tools, in a hidden world away from the manufacturing processes.

The operators are tasked with ensuring that the manufacturing system is productive, available and reliable by overseeing the complex process set out above. The progress of the stages of the industrial process – cleaning the wafers, manufacturing the various layers, etching the circuits to name a few – can

be easily disrupted by the smallest risk arising from interconnected production and monitoring systems: this is undoubtedly why in the job description, summarized in Table 2 below, there is a heavy stress on working in compliance with the systems and within the production constraints. For example, there is mention of “follow[ing] safety rules”, “keep[ing] close to the procedure error rate”, “only carry[ing] out manual operations on a piece of equipment with prior authorization”, and “respect[ing] the recovery time”.

The operators observed in the cleanroom have worked in the plant for several years and so have experienced the introduction of some of the automation stages. When asked, the operators voiced their reservations and a certain degree of resignation concerning the apparent benefits of this progressive automation and digitalization approach:

“Algorithms are created for an ideal world...”; “When it comes to computing, you can’t create things from random”; “[All of us] in the production department [are] surprised”.

Overall assignment	Efficiently operate equipment to ensure the product can be delivered from a qualitative and quantitative standpoint.
Safety	Follow the rules in force, and report any potential risks.
Quality	Keep below the procedure error rate, detect and report batches at risk of exceeding constraints.
Monitoring	Adopt closer surveillance, oversee the entire area under your responsibility and monitor flow activity in your area.
Production management	Observe full automation rules, only carry out manual operations with prior authorization, schedule/oversee the batches throughout the production process based on instructions given.
Communication	Ensure instructions are given to the subsequent shift team, respect the recovery time, encourage constructive talks, and act within the organizational and reporting line processes.
Teamwork	Respect attendance rates and the working hours, and adhere to rules for requesting leave and the clean concept.
Ongoing improvement	Suggest improvements for tools, processes and the work environment. Suggestions must be substantiated, demonstrating the potential benefits thereof.

Table 2: Job description in summary form.



## Interpretation and discussion: working in the Industry 4.0 era, an objective experience WITH collective and subjective DIMENSIONS

There are two major factors that are common to these operators: an almost obsessive pursuit of performance enhancement, and the relationship with time constraints which are highly present across the entire product manufacture cycle. This “sedentary race for activation” is the result of efforts to combat cognitive overload: the flow of information is considerable, there are a wide variety of tools available, and many orders can lead to the need to make decisions and compromises. In this respect, work experience is not purely objective, but also collective and subjective in nature; paradoxically, this work becomes all the more human-centric as automation increases, requiring a change in HR management practices for this group of individuals.

### An objective experience that also has collective and subjective dimensions

The successive stages of automation and use of digital decision-making tools could suggest that the human workload is reduced and facilitated, as the operators can stay focused on their computers and need to discuss matters with others much less. However, analysis has in fact pointed to the contrary: we have observed a ballooning objective dimension of work, a collective work experience characterized by close interaction, and ultimately a subjective dimension distinguished by several points of tension and a pursuit of recognition.

#### A ballooning objective dimension of work

“We’re not kept in the loop, we don’t exist to them, they treat us like robots”.

This quote from an operator may seem dramatic, but it actually is fitting when considering the long list of factors relating to the objective dimension of this work. For a first, this work is conducted in a cleanroom, a space with a controlled environment so as to attain optimum levels of cleanliness, a necessity for manufacturing electronic components at micro scale. The temperature (21.5°C – +/-0.5°C throughout the year), humidity and air pressure are kept at a specific level and the air flow is continuously filtered. These work environments are classified using a scale of 1 to 9 (ISO 1 to ISO 9), and so audits that do not identify the business are conducted, activity tracking measures are implemented and rules of conduct are enforced.

When they first join, operators undergo onboarding and are given their specific instructions. They are responsible for at least twenty or so technical tools – namely equipment and tools for monitoring flows, constraints and anomalies – and for the new digital assistance interface for monitoring. Operators “take stock of the inventory” both in terms of productivity (with specific priorities set for them) and quality (with the identification of equipment that no longer works, or of batches that are blocked).

In addition to tools and their respective performance indicators, other factors demonstrate the objective dimension and its major significance in the operators’ work. For example, their working environment is deemed “a world of its own”, with the requirement for operators to wear a standard coverall helping to start discussions and keep them flowing, bringing down any social disparities:

“It gets people talking; we’re all on equal footing”.

Operators consider themselves to be working for the engineers in the offices (“little helpers”) to ensure that the set time frames are respected. This sentiment appears to be stronger among the day shift teams given the R&D engineers’ presence on site at this time, while the night shift teams play catch up for any set-backs in activations that occurred during the day. The operators’ activities are defined by three key factors: (i) their varied nature (“I never know whether it’s going to be a relaxed or tricky day”); (ii) receiving instructions so that operators can “take stock of” the inventory from one shift team to another (“this points out the trends to us”); and (iii) the pressure of pursuing enhanced performance (“activation occurs every 30 minutes”, “it’s a sedentary race”) – even on a voluntary basis to find meaning in work (“I’m going to seek out that little additional gain”).

At the end of their shift, operators have to get ready to hand over and provide priority information to the next team. With the aid of technical tools, they report on past activity and “check out” by taking stock of the end-of-shift inventory. For them, it is a case of quickly closing off their activities that will be picked up by others.

#### A necessary collective work experience involving many interactions

Shadowing the teams during their shifts allowed us to note that, contrary to what may have been expected, there is a strong collective work experience in the plant. This is particularly the result of risk management, which operators believe accounts for two thirds of their workload:

“The tools raise too many false alarms and change their minds every seven seconds”; “We solve one problem, and then another pops up which triggers another one”.

The presence of risks in an over-automated production process may be surprising: the risks have in fact not disappeared but have increased in number and decreased in severity due to the complex nature of industrial processes, which cannot be fully controlled. These anomalies in the production process require human intervention: operators therefore need to carefully evaluate and select from a large amount of data aggregated by IT tools. This is why operators must cooperate with others to obtain and cross-reference information:

“There’s a contact person for every blocked batch”; “You have to get along with your colleagues”; “Ultimately, once you know how to connect with others you will have a handle on this job”.

While the team members who have been at the plant longest recall group work that was once much simpler (“Before there was a collaborative effort made for substantial tasks”), this collective dimension does not reflect smooth and evident collaboration:

“We get by with what we have”; “I don’t know how many contact people we have”; “Each person protects their own interests”.

There is therefore no work group, but rather smaller groups that are formed or reformed and deemed scalable (*i.e.* of variable size), created with a view to acquiring useful information.

This collective work experience, required to manage risks, is formed from a web of necessary interactions between operators. Although “everyone does their own job”, “you need to get along with your colleagues”, “you need to identify information at all levels”, and, “you depend on the other workshop”.

### **A subjective experience with many areas of tension**

Faced with an encroaching objective dimension in their work, as well as the need to rely on one another, operators have a subjective experience of their work that is mixed to say the least. On the one hand this is a good thing – when asked to describe their activities, operators for example found pleasure in their work thanks to the human interaction involved, the intellectual stimulation, the learning opportunities and the variety of shift tasks. A more unexpected finding was that they mentioned that inherent and primarily personal competencies such as interpersonal and social skills, meticulousness and an inquisitive nature are required to carry out their work.

However, the subjective experience of these operators working in Industry 4.0 is also negative. Faced with increasing automation, operators bemoan their reliance on tools (“We are now dependent, we are no longer worth anything”) and on equipment (“When a machine breaks down, it really breaks down”). In their view, the progress made in the Industry 4.0 organization process is not necessarily always encouraging news, since specifically human qualities are lacking:

“We have lost knowledge with employee turnover”.

While automation does – and is acknowledged to – reduce the arduous nature of the work, the cognitive overload caused by machines has been singled out:

“The mental workload is huge; the work piles up and we can’t handle it”.

In this respect, operators talked about their dilemmas when faced with orders that could easily be considered paradoxical: ensuring quality but also productivity, staying alert while also rushing to complete as many activations as possible, following the set procedure but also having to intervene. As one technician put it:

“They don’t want to make a choice; they want to be able to do everything”.

Managing these areas of tensions could be eased by management officially recognizing them, but this is rarely the case: as an illustration, management believes that risk management only constitutes 10 to 15% of operator workload. The subjective work experience for operators is therefore defined by this push for recognition:

“We are always fighting to get more information, and all the time we have to explain the problems faced, justify ourselves and draft reports. Nobody is aware of the workload”; “Managers have a rigid perspective, [...] in the production department we see things in real time”.

### **Work becomes increasingly complex and human-centric as automation ramps up**

As mentioned earlier, given the current state of knowledge of Industry 4.0, one of the clear findings made was that this technological development had the unique quality of exponentially increasing the number of human-machine interactions that require not only technical skills but also methodological and social ones. Our analysis of the work experience of operators in the case study corroborates this finding, demonstrating that human-machine interface forms part of their interactions. Their profession particularly requires interpersonal skills, and they need more social qualities to succeed at work. An inquisitive nature, strong social skills and a competitive streak also emerge as required competencies and personality traits.

However, the plant under examination has revealed three factors that have been overlooked in research available thus far and even more so in corporate presentations on the “industry of the future”:

- The first factor is that the high level of automation and computerization has not necessarily made work in the plant easier or more flexible: automation and the introduction of an IT interface for monitoring have made decision-making more complex, and the physical toil has been replaced with cognitive overload. IT interfaces made possible with technological progress are definitely a “tool to be used tentatively”, but also add another layer of abstraction.
- The second new factor revealed by the case study is that the collective dimension of work has not been eliminated: while there is no longer a general and stable work group in the workshop, there are still many interactions between individuals that represent ad-hoc groups. When interacting with others in person or remotely, operators are able to consolidate and cross-reference information that is sometimes based on potentially different interpretations; in time and with experience, they learn who to contact and, after many exchanges, to tell the difference between real and false anomalies.
- The third factor is the most important in our view: the fact that the required evaluations and human-made decisions have become more difficult since, according to operators, they do not receive the recognition they require. The operators talked of a “fatigue to report”, a “serpent eating its own tail” and a “wasted effort”: “it ushers in a lax attitude, and breeds contempt”. This subjective perception of a lack of recognition is certainly a point of attention for management, which is preparing for the next and final stage in automation – the establishment of a remote control room. This project entails setting up a remote operation center (ROC) and relocating operators from the clean-room so that they can specialize in tracking anomalies using a new computerized assistance tool for

monitoring based on huge quantities of data. This new frontier of Industry 4.0 will allow for, in the words of a manager, “streamlining, a departure from the routine” and optimized monitoring activity, so that productivity losses resulting from anomalies can be minimized. However, at the time of our study, only a small minority of operators support this new step in Industry 4.0, with many concerned that the individuals involved will be isolated from others and cut off from people with whom they must stay in contact in order to carry out all the necessary evaluations and decisions:

“We need to know the contact people, otherwise we have no connections”; “If we are away from the site, we are of no use”.

### A change in HR management is required for these operators

In this case study, the HR department is rarely or never called upon by the cleanroom’s management to contribute to its discussions on the organization of Industry 4.0 manufacturing; this is undoubtedly the result of an engineer culture that is first and foremost focused on technology and a particular perception that HR managers primarily focus on social relations. Nevertheless, changes in the HR management practices for operators would be welcomed following on from the analysis of the work experience that we conducted, particularly to support the establishment of the future remote control room. We believe that two specific changes are crucial.

The first change we recommend relates to recognizing the work for what it truly is. As it stands, operators believe that their activity is inadequately and unfairly assessed:

“Managers don’t understand the profession and yet they’re the ones rating me? HR recruits new staff [but] they also don’t have a clue about the job”.

We noted a significant discrepancy between management’s perception of risk management and that of the operators: a useful first step would be to officially recognize this discrepancy and work to construct a shared perception of risk management, along the lines of Perrenoud’s suggestions (2019). Perrenoud posits that managing unexpected events is part of any high-level skill. Another approach to achieve recognition that we suggest is to work on the required and employed skills of operators, using the terms coined by Retour (2005). The job description for operators, summarized above, details the mandated work and lists the expected skills that mainly relate to the observance of engineering rules. However, after shadowing workers, we noted many skills that were used but not required according to the job description, such as the ability to identify the right contact person and to evaluate and select several information sources in real time. If the HR department launched a project to elucidate the skills actually used, not only could the job description be updated but also the problem of the operators’ lack of visibility – a concern for many of them – would be avoided.

“We’re given too little consideration”.

The project could lead to an expansion in assessment criteria, compared to the current situation in which the assessment of operators continues to be focused solely on the number of wafers manufactured and compliance with the process.

A potential second change that we suggest is to expand and foster spaces for dialogue. The concept of spaces for dialogue, based on the fundamental work of Clot (2015) and Detchessahar (2013) is increasingly considered a practical solution to psycho-social risks; this mechanism was mentioned in the Lachmann, Larose & Pénicaut report in 2010 and then explicitly called for in the National Multi-Sector Agreement of 19 June 2013. In the cleanroom, the many interactions observed between operators, required to diagnose risks, are in fact micro-spaces for dialogue. However, in this case, these spaces are reserved for the operators. Discussions on job performance are therefore incomplete:

“The people in the field feel like they are not being acknowledged, that others are deciding what to do with the cleanroom without asking for their opinion”.

We suggest using the onboarding period as an opportunity to consolidate and expand these spaces for dialogue with the superior.

## Conclusion

In a pursuit for increased performance, heightened by the global boom in the semi-conductor market, the business examined in our case study, which started the Industry 4.0 process quite some time ago, is about to embark on a new stage involving the outsourcing of anomaly control. Shadowing in the cleanroom allowed us to shed light on the little-known reality of Industry 4.0 work: a ballooning objective dimension in which cognitive overload supplants physical toil; a collective dimension that is still necessary but scarcely acknowledged, and; subjective work experience with several areas of tension and a desire for recognition. Working in Industry 4.0 is undoubtedly more human than expected: far from replacing humans with machines, it reconfigures humans’ relationship with equipment and calls into question individual and collective ways of working.

There were limitations to this research project: the case study focused on the perspective of operators, but the views of other stakeholders such as on-site management should also be taken into account. Our observation period also took place during a large-scale change i.e. the establishment of the new control room, which could call some of our current conclusions into question. Because of this, we are planning to continue our research to observe the implementation of this new work situation, to identify the defining characteristics of the new monitoring activity, and understand its repercussions on actual work and on the skills used.

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# Is Kodak's collapse a closed case?

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Kodak's bankruptcy is generally considered to be an exemplary case of disruption. Our objective is to revisit this assertion, which has circulated widely among researchers and the general public.

A systematic analysis of company data published between September 2003 and January 2008 demonstrates that disruption theory does not fully explain Kodak's decline. In particular, our analysis highlights the role played by shareholders in rejecting the company's initial digital strategy.

Our findings demonstrate the impact of shareholder activism on disruptive innovation strategies. They also allow us to discuss the risk of circularity bias in using case studies to illustrate theoretical approaches.

## Introduction

In a matter of a few years, under the influence of Clayton Christensen's work (1995, 1997, 2003), the concept of "disruption" took over the media, decision-makers' discourse, academic journals and management textbooks. The effects of disruption on business competition now seem proven and those wanting to describe and explain its mechanism keep turning to what has become an iconic example: Kodak. On the surface, it is the perfect case study, bearing all the hallmarks of disruption as it has been described by Christensen: a leading established firm thought to be invincible, a disruptive technology conducive to the entry of new firms and a business model wiped out in just a few years.

However, do the criticisms that have been levelled against the managers of the Rochester-based fallen giant stand up to the facts? Ever since Richard T. Pascale published his seminal paper on Honda (1984), the wisdom of interpreting situations through the lens of accepted theories has become a central question in strategic management. By revisiting the story of the Japanese automaker's entry into the US market, the paper shows that strategic decision-making involves complex, and sometimes even paradoxical, processes. It also demonstrates that researchers should be wary of overly "mechanistic" explanations and challenge them by closely re-examining the facts of the case. Through an in-depth chronological analysis of events, managers' decisions and positions adopted by stakeholders impacted by the shift from analogue to digital technology, our paper seeks to revisit assertions about Kodak that have circulated widely among researchers and the general public.

To this end, we carried out a systematic review of company-related announcements, press releases and articles published between September 2003 and January 2008. September 2003 is when the company

unveiled its digitally-oriented strategy, while January 2008 corresponds to when Kodak's management announced that it had completed its digital transformation strategy. The latter turned out to be a failure: in 2012, the company filed for Chapter 11 bankruptcy protection under US law.

The first section of our paper introduces disruption theory and how it is used to explain Kodak's bankruptcy. The second and third sections present our methodology and findings, respectively. Although one may criticize the company's managers for belatedly realizing that a transformation was in order, not to mention their inability to handle internal pressures, our analysis demonstrates that the role played by shareholders cannot be ignored. In fact, Kodak's shareholders rejected the company's initial transformation strategy and argued for a "transition strategy" which would allow the firm to continue to leverage its legacy business model centered on film photography.

Our study reveals the conflicting imperatives of responding to a disruptive innovation with an appropriate strategy and meeting certain shareholders' expectations. In the fourth section, we present our findings, including the impact shareholder activism had on Kodak's disruptive innovation strategies.

## Is Kodak an exemplary case of disruption?

After providing an overview of the literature on disruption, we will discuss the most common explanations given for Kodak's decline.

### A definition of disruption

The literature on disruption is part of a body of research which aims to gain insight into technological development processes, the integration of technologies into

services and the mechanisms that can lead a company to change or retain its technology. The management of technology portfolios became a subject of management science research in the 1980s, notably with the publication of works by Richard N. Foster (1986) and Pierre Dussauge and Bernard Ramanantsoa (1987). All this literature established the concept of the “technology life cycle”, which helps us understand the inherent dynamics of technologies and the choices, ranging between sustaining and disruptive technologies, available to a firm. The idea that technologies have life cycles is now an accepted one. They go through four phases: research and development, growth, maturity and decline. The concept of life cycle facilitates our understanding of the dichotomy between radical and incremental innovation, and the underlying technological challenges. Incremental innovation involves extending and moving up an S-curve while radical innovation involves choosing a new technology and, in so doing, creating a new curve.

Dating back over 35 years, this literature underscores the preference that large industry leaders have for sustaining innovations and the strategic missteps that can ensue. How and why do established firms fail to meet the moment when a shift towards a new technology occurs? This is the question Christensen asks in his first works (Bower and Christensen, 1995), leading to the publication of his most well-known book, *The Innovator's Dilemma* (1997), in which he uses the S-curve to describe the mechanism of disruption.

Indeed, the technology life cycle curve serves as a reminder that R&D investment can have a more or less significant impact on how well the proposed technology performs. As the technology advances along the curve, progress slows down. In the maturity phase, the marginal efficiency of investment begins to decrease, while in the decline phase, progress becomes increasingly rare since the technology's inherent limits have been reached. This last phase is mainly when the “innovator's dilemma” arises: should resources be used to try to expand the limits of the technology in question or should they instead be allocated to developing and/or exploiting a new disruptive technology? On the one hand, it is easy to see why a firm that concentrates its R&D efforts exclusively on improving its existing technologies can be made vulnerable when a disruptive technology emerges. But on the other, exploring new possibilities is not an easy decision to make. In fact, in early stages of development, the new technology generally performs worse than the old technology. This key point, discussed in disruption theory, can be illustrated using the example of photography. When the first digital camera appeared in 1975, it weighed 3.5 kilos, took poor quality photos and users had to wait 23 seconds between shots. At the time, digital cameras had a very limited potential compared to film cameras.

However, even if an innovation performs worse when using traditional assessment criteria for established products, it gradually begins to align with the expectations of non-customers and fringe customers. Thanks to the support of these early adopters, the innovation can begin to move up along its S-curve: its performance continuously improves, allowing the innovation

to win over an ever-growing number of customers. Accordingly, disruption can be defined as the mechanism by which an established firm will underestimate the disruption caused by a new technology, as the latter introduces new performance criteria.

Christensen's follow-up, *The Innovator's Solution* (2003, co-authored with Michael E. Raynor), expands on his earlier analysis. He no longer poses the “innovator's dilemma” in strictly technological terms, as he also incorporates the idea of business models. In this work, he defines disruptive innovation as a type of innovation that introduces a new business model and demonstrates how tricky it is for an established firm to change its business model. A firm's existing management team cannot see the disruptive innovation as an opportunity because it would no longer allow the firm to make use of its resources, expertise and customer base. This is described as “the tragedy of the business model” (Silberzahn, 2014a and b), as the business model is both the instrument of the firm's success and what dooms it in the event of disruption.

### **Kodak: a case in point?**

Christensen's body of work came back into popularity with the widespread interest in startup firms, digitalization and “uberization”. In many industries, the introduction of new technologies made it possible to completely overhaul “the ways of doing business”. These technologies brought about new firms offering revamped products, disrupting established firms that did not immediately have the expertise and infrastructure to match their new competitors. Kodak is frequently used as a case study to illustrate all these changes.

Founded in 1881 by George Eastman, Kodak established itself as the world's leading photography company thanks to its renowned expertise in the manufacture of photographic film emulsion for amateur and professional photographers and the motion picture industry. Kodak's “golden age” lasted from the 1960s to 1980s. In 1976, 90% of camera film and 85% of cameras in the United States were produced by the firm (Silberzahn, 2014b, p. 11), which had almost 80,000 employees worldwide. But starting in 1995, digital technology began to make real inroads into the photography industry. At first, the leading global firms in the camera and film market – Kodak, Fuji, Nikon, Canon and Minolta – united their R&D efforts to launch a standard film format called the Advanced Photographic System (APS). A hybrid of both digital and film technologies, the product had the benefit of allowing these firms to preserve their business models. However, in 1996, new fully digital camera models were introduced and enabled users to store photos in memory. With these devices, pictures could be saved, retouched, inserted into a document and shared on the internet. Most of the manufacturers producing digital cameras came from outside the traditional photography world, but were digital technology experts.

Digital camera sales were growing at an impressive rate, but Kodak, the global leader, had a hard time managing the disruption. Originally specializing

in chemistry, the company would have to turn its attention to electronics. Its business model, which had been based on the sale and development of film, needed a complete overhaul. To address the decline of its legacy market, Kodak became engaged in a series of restructuring programs between 2002 and 2008. Despite these efforts, its financial situation continued to deteriorate. In January 2012, the company filed for Chapter 11 bankruptcy protection under US law.

Over the years, numerous researchers have portrayed Kodak as the quintessential example of a leading incumbent wiped out by disruption. Back in 2009, Henry Lucas and Jie Mein Goh explained Kodak's decline using disruption theory. While these authors confirmed Christensen's conclusions, they also suggested deepening his theory, demonstrating how the company's culture, bureaucratic structure and middle managers prevented a swift transition towards digital technology. Subsequently, Philippe Silberzahn dedicated an entire chapter to the Rochester-based giant in his work on "the tragedy of the business model", the "challenge of disruptive innovation" and the "failures of organizations faced with disruptive innovation" (2014b)<sup>1</sup>. In an article from 2016 published in the *MIT Sloan Management Review*, Willy Shih also delved into Kodak's experience. The author put forward the argument that senior management was already concerned about the rise of digital photography in the 1990s, but that the firm was unable to resolve management issues preventing it from pulling off the transition from analogue to digital photography. Also in 2016, in an article appearing in the *Harvard Business Review*, Scott D. Anthony (2016) reached a similar conclusion: it was top management's inability to appropriately change its business model that led to Kodak's demise. In a similar vein, Christine Kerdellant's book *Histoire des grandes erreurs de management* (2016) explained Kodak's collapse by advancing the same theory about the company's inability to reboot its business model. The chapter in question has a particularly telling title which roughly translates as "the fear of the cannibal" (*La peur du cannibale*).

Evidently, Kodak's story seems to fit with every aspect of disruption theory as articulated by Christensen. The seemingly close connection between disruption theory and what transpired at Kodak has even led some authors to suggest the term "kodakization" as a synonym for the failure to adapt to technological change. It should be noted, however, that all this research is based on relatively inadequate data collection methods or, at the very least, unclear ones. Moreover, this research has been conducted after the fact, with researchers readily adopting Christensen's ideas as a theoretical framework to further build on them or illustrate them again, rather than comparing them to a new set of circumstances. Lastly, this research tends to focus on the decisions made by Kodak from the mid-1990s to the early 2000s, while disregarding the significant strategy the company drew up in 2003 (aside from the work of Lucas and Goh,

2009). As a result, such researchers implicitly assume that Kodak should have positioned itself as a pioneer of the digital photography market, even though the literature has demonstrated that this type of strategy is far from being a panacea (Demil, 2009). Furthermore, if Fuji, Kodak's legacy competitor, managed to survive the end of film photography, it did so by implementing a bold strategy in 2004, after film sales peaked worldwide in 2001 (Kmia, 2018). So the important question seems to be this: do the criticisms that have been levelled against Kodak's managers stand up to the facts? The research methodology Christensen used to develop his disruption theory has, after all, come under much criticism (Weeks, 2015).

## Revisiting the Kodak case

To revisit Kodak's collapse, we carried out a systematic review of company-related announcements, press releases and articles published between September 2003 and late January 2008. September 2003 is when the company unveiled its digitally-oriented strategy, while January 2008 corresponds to when Kodak's management announced that it had completed its digital transformation strategy. We gathered additional information on Kodak dating up to January 2012, when the company filed for Chapter 11 bankruptcy protection under US law. However, for the 2008-2012 period, we did not identify any events that could undermine our analyses.

We sought to reconstruct a chronology of major events for the 2003-2008 period without using a pre-determined theoretical framework, in order to avoid circularity bias (Dumez, 2013). After describing our methodology, we will detail the chronology it allowed us to reconstruct. New explanations given for Kodak's collapse thus emerged gradually, as the research protocol unfolded.

## Methodology

Our study is based on secondary data. It is now accepted that new knowledge can be generated using this type of data (Chabaud and Germain, 2006), if such data undergoes a rigorous selection process (Stewart, 1984). Our research protocol involved four steps:

### Step 1. Data collection

We used two types of secondary data: firstly, internal secondary data, meaning documents prepared and disseminated by Kodak and compiled for the period under study. Secondly, we performed a keyword search using the Dow Jones Factiva news database for the relevant period. Various automated searches then enabled us to select and verify additional information. To ensure the reliability of the information gathered from the articles, we only retained information found in at least two different named sources. In addition, we compiled a few TV and radio documentaries covering Kodak's collapse. All this collected data made it possible to provide an account of the environment in which Kodak's management was operating in the early 2000s. In particular, we were able to retrieve data regarding the company's competitive position and sales of film cameras and

<sup>1</sup> This is also true of Silberzahn's 2015 book on disruptive innovation. Kodak is also used as a case study in a chapter of a collective volume on Christensen's body of work, published in 2016 and co-authored with Ben Mahmoud-Jouini.

digital cameras, as well as anticipated market trends. This allowed us to assess Kodak's financial situation without running the risk of being affected by choice-supportive bias.

### Step 2. Reading of compiled articles

This step served two purposes. First of all, it sharpened our knowledge of the Kodak case for the period under study. Second of all, it was meant to help us identify the key events, defined here as the occasions when the management team had to make strategy decisions or, conversely, was influenced by decisions made by other actors. Six key moments were identified:

- September 2003: announcement of the digitally-oriented strategy;
- December 2003: reboot of the initial strategy;

- May 2005: Kodak's debt rating lowered to speculative-grade, leading to the CEO's replacement;
- July 2005: extension of Kodak's restructuring program;
- August 2006: new restructuring program and sale of Kodak's Health Group;
- January 2008: management's announcement of the completion of Kodak's digital revolution.

### Step 3. Analysis of the key moments' impact on each phase

The identification of key moments made it possible for us to break down the period under study into phases. For each phase, we examined the impact of the company's decisions on its financial situation, financial performance, the position of the main stakeholders affected

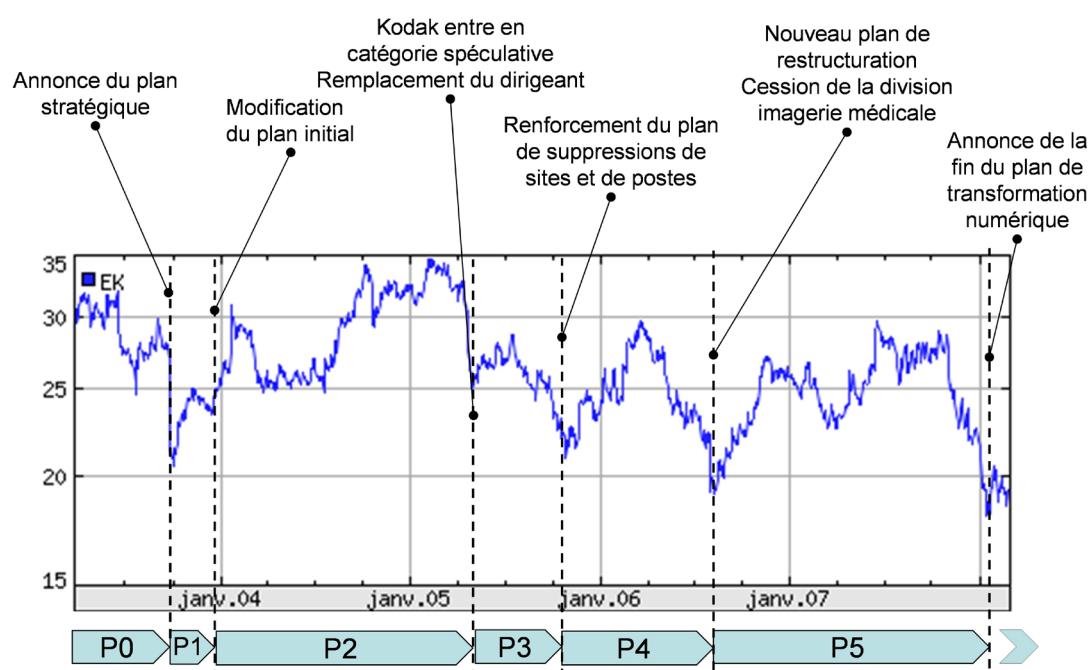


Figure 1. Identification of the key moments, breakdown into phases and changes in Kodak's share price

FR	EN
Annonce du plan stratégique	Announcement of the digitally-oriented strategy
Modification du plan initial	Modification of the initial strategy
Kodak entre en catégorie spéculative	
Remplacement du dirigeant	Kodak rated speculative-grade
Appointment of new CEO	
Renforcement du plan de suppressions de sites et de postes	Extension of the employment and facility cost reduction program
Nouveau plan de restructuration Cession de la division imagerie médicale	New restructuring program
Sale of health imaging business	
Annonce de la fin du plan de transformation numérique	Announcement of the end of the digital transformation strategy
janv. 04, ...	Jan. 04, ...



by these decisions and Kodak's share price. We were able to discern the impact of these key moments on the value of Kodak shares (see Figure 1), as well as shareholders' many reactions. It was during this step that we understood the value of focusing on stakeholders.

#### **Step 4. Analysis of the interactions between management and shareholders**

Shareholders' numerous actions, which we identified in the third step, prompted us to conduct a more extensive analysis of the impact of managers' decisions on these stakeholders, and of management's reactions to some of their demands.

#### **Kodak's decline: A chronology of events<sup>2</sup>**

Figure 1 shows the key moments identified and their breakdown into phases, as well as the impact of these events on share price.

In the early 2000s (P0 in Figure 1), Kodak was in a precarious position, even though it still laid claim to being the world leader in photographic film. The Rochester-based giant was still generating more than two-thirds of its sales from the traditional photography market, but this market had been undergoing a major transformation ever since the emergence of digital technology in the mid-1990s. In 2002, global sales of digital cameras exceeded those of film cameras. Seemingly nothing could stop the rise of digital photography (5.5 million digital cameras were sold in 1999 and roughly 50 million in 2003), which upended the competitive environment. A number of legacy camera manufacturers were already trying to tap into the digital market and did so rather successfully, like Canon, which in 2003 sold one film camera for every three digital cameras. Furthermore, the introduction of a new technology facilitated the emergence of new competitors, with Kodak henceforth competing against computer (Hewlett-Packard) and consumer electronics firms (e.g. Casio, Sony and Samsung).

These technological and competitive changes encouraged Kodak's CEO, Daniel Carp, to invest in developing its digital imaging business and engage the company in a series of restructuring programs. Their measures notably included the elimination of as many as 8,400 jobs in 2002, 6,000 layoffs in 2003 and the closure of two plants in the United States and Mexico.

In April 2003, Antonio Perez was named president and COO of Kodak. After a career at Hewlett-Packard, where he was in charge of digital operations, he was tasked with accelerating Kodak's transformation. In September of that same year, the company announced a bold strategy which included plans to spend \$3bn on investments and acquisitions (P1 in Figure 1). Given its high level of debt, which also totaled \$3bn, Kodak had limited options for raising cash and its management announced that dividends would be reduced from 1.80 to \$0.50 per share. This decrease was meant to free up cash of \$1.3bn over four years, but it was insufficient. As a result, the company sought to cut costs in its

traditional businesses, including ending investments in traditional film, in addition to selling and closing some of its operations to save \$1bn. Management's ambitious objective was to offer a comprehensive range of digital cameras and to expand digital products in three other segments: printers, digital photo processing labs and health imaging. This undertaking to shift to high-growth segments led the company to project that it would generate sales of \$16bn in 2006 (compared to \$12.8bn in 2002) and \$20bn in 2010.

However, many actors were very skeptical about the announced strategy. Questions were raised regarding two main aspects. Firstly, Kodak's chances of succeeding appeared very slim to certain analysts. To become a major digital player, it would have to invest massively in R&D, yet the company was already heavily in debt. In addition, the credit ratings agency Moody's expressed concern about Kodak's ability to make up its lost ground by downgrading the company's long-term debt rating and encouraging investors to closely monitor its performance. Secondly, Kodak already had a host of competitors in the photography market as well as in printers (Xerox, Hewlett-Packard, Epson, Dell) and health imaging (General Electric).

The financial community reacted swiftly to the announcement of the strategy. That same day, Kodak shares lost 18% of their value, reaching their lowest ever price in 20 years (see Figure 1). Kodak shares risked being excluded from the Dow Jones index for the first time since their inclusion in 1930. The credit ratings agency Standard & Poor's demonstrated concern over Kodak's earnings and business profile, deciding to lower the company's long-term credit rating to BBB-, putting it just one notch above a speculative-grade credit rating. Meanwhile, shareholders were not willing to accept the strategy given the planned dividend cut. In October 2003, Kodak's management was confronted with a large number of disgruntled shareholders who deemed the new strategy too risky and the dividend cut unacceptable. Some 100 dissident shareholders controlling 25% of Kodak's shares decided to form a group to increase their influence over management's strategy decisions. Its members included Bill Miller, who was running the mutual fund Legg Mason Value Trust, which was Kodak's top shareholder at the time, with a 4.5% shareholding. The group's aim was to force the company's managers to scrap its shift in strategy and to try alternative strategies that would create more shareholder value. To achieve their goals, they got behind the investment firm Providence Capital, whose specialty was this type of endeavor. Business journalists were reporting at the time that Kodak's managers were meeting once a week with representatives of the group of dissident shareholders to try to reach an agreement. Their counter proposal focused on four main points: favoring cost-cutting measures, taking advantage of the company's dominant position in film photography markets, implementing a more aggressive policy of licensing its many patents and maintaining, or even raising, dividend payouts.

In November 2003, there was a new turn of events: The American corporate raider Carl Icahn received the

<sup>2</sup> The paragraph that follows draws on a previously published work (Tellier, 2014).

green light from the Federal Trade Commission (FTC) to purchase \$500m worth of Kodak shares, *i.e.* 7% of the company's market capitalization. Icahn had been a well-known figure in the financial world ever since gaining notoriety for the numerous corporate raids he led in the 1980s (at which time he was carrying out one raid every three months, on average) against large corporations such as Texaco, US Steel and TWA. On each occasion, he went after firms he felt were undervalued, acquired a stake in them and influenced their decisions before reselling the shares. For many investors, the circumstances were ideal for a corporate raid, as Kodak shares had lost 70% of their value since 1999 and the group of dissident shareholders was looking for allies to promote their strategy.

Icahn's raid of the company and the dissatisfaction of "legacy" shareholders forced managers to rework their initial strategy at the end of 2003 (P2 in Figure 1). In various press releases, Kodak's management said at the time that, contrary to what had been stated, they did not intend to abandon film photography and that the company would continue to be a dominant player in the traditional photography market (*La Tribune*, 22/12/2003). They began referring to the company's "transition" instead of its "shift".

Managers said that their goal was to continue leveraging the film market which, by their projections, would decline by 10% a year in the United States and 5% in the rest of the world. They added that they planned to take advantage of the Chinese market, where only 20% of the population had access to photography and digital cameras remained luxury items. Management had also confirmed in early 2004 that the company would continue to sell film products (film cameras, film and disposable cameras) in eastern Europe, Latin America and India.

Kodak did not scrap its initial strategy entirely, however. It entered into partnership agreements with mobile phone operators and the manufacturer Nokia to expand its service offering for mobile phone users wanting to store and print photos. In parallel, Kodak paid \$500m to acquire the dental imaging company Practiceworks and \$250m to purchase Scitex's digital printing division, which at the time was the world's leading manufacturer of high-speed ink-jet printing systems. Meanwhile, the company maintained its cost reduction programs. In January 2004, it announced a plan to cut 12,000 to 15,000 jobs by 2007. Management also confirmed its intention to reduce the worldwide square footage of its manufacturing facilities by one-third. All these measures would save almost \$1bn a year.

Nonetheless, the company's financial performance continued to deteriorate. In 2003, it posted net earnings of \$265m, representing a decrease of 66%. Shareholders seemed to be the only ones satisfied with Kodak's new direction (the share price rose again in January 2004 – see Figure 1), while analysts and industry actors were more skeptical. In addition, Kodak was ultimately removed from the Dow Jones index and the company's decisions did not have a positive effect until late 2004. In the United States, Kodak increased its digital camera market share to just under 22%, putting it close to that

of the leader, Sony, while reporting sales of \$13.5bn and net earnings of over \$550m.

Despite these positive signs, 2005 turned out to be a particularly difficult year for Kodak. The assumptions on which its transition strategy was based were not borne out. Sales of traditional film fell much faster than expected. The company's growth in emerging countries, which was supposed to offset the decline in film sales, also fell short of expectations. Restructuring and licensing costs ballooned, and its debt exploded. Kodak's share price plummeted and the ratings agencies Standard & Poor's and Moody's downgraded Kodak to a speculative-grade credit rating (P3 in Figure 1). On 12 May 2005, Kodak announced the departure of its CEO, Daniel Carp, and the appointment of Antonio Perez as his replacement.

In July 2005, Perez announced the extension of Kodak's employment and facility cost reduction program: "Sales of our consumer traditional products are declining faster than expected, although we have been moving rapidly to get our costs down" (*AP*, 20/07/2005). 25,000 jobs were ultimately cut, more than the 15,000 originally planned in 2004. Europe, where the company had many facilities, was especially hard hit. With the financial community reassured by the program, Kodak's share price rose (P4 in Figure 1).

In January 2006, Kodak released its financial results for 2005. Sales increased significantly, reaching over \$14bn, but the company nevertheless reported a net loss of \$1.37bn. Perez appeared to be satisfied with these figures, stating in a press release: "We are now more than halfway through our transformation, and we have proven our ability to drive sales in digital markets and to generate the cash necessary to fund our growth" (*La Tribune*, 31/01/2006).

However, the company had an even worse year in 2006. In August, sales were down by 9% and the restructuring program took additional action, eliminating another 2,000 jobs. On the New York Stock Exchange, Kodak shares tumbled more than 13% to \$19.20 (P5 in Figure 1). In September, management announced that it was seeking out new sources of financing to increase its digital investments and that it planned to sell its health imaging business (the sale was made official in January 2007). In parallel, Kodak closed its last remaining film labs, including in France, where the traditional film market had plunged 40% in 2006. All these decisions seemed to be delivering results. After 24 consecutive months of losses, and despite lower sales, the company finally managed to report a profitable fourth-quarter 2006. For the year, Kodak reduced its net loss to \$601m, mainly attributable to sharply growing profit in the digital imaging segment (up by 275%). Perez decided after that to take up the offensive. In February 2007, the company announced 3,000 job cuts and the launch of a line of affordable printers in a bid to compete with market leaders.

Unfortunately, despite these restructuring efforts, Kodak's financial health was not improving significantly and its share price, which had remained stable in the first three quarters of 2007, fell again in September. Nevertheless, in early 2008, the company announced

that its repositioning in digital imaging was now centered on its in-store digital printing business and consumer printers. On 30 January, management asserted that it had completed its digital revolution. But it came at a high price, with almost 30,000 jobs eliminated, businesses sold, facility closures and around \$3.5bn lost.

However, from that point forward, the company would never report a profit again. In January 2012, Kodak filed for Chapter 11 bankruptcy protection under US law. Even though its digital business accounted for 75% of its revenue and that it had reduced its employees to 18,000, it was in a critical position. In its filing, the company listed assets of \$5.1bn and a debt of \$6.8bn. Its share price fell to \$0.55. In gaining protection from its creditors, management hoped to be able to fund a turnaround.

## Findings

What lessons can we draw from the chronological analysis that we summarized above? In the first part of this section, we will revisit the content, means and various iterations of Kodak's 2003 strategy. In the second part, we will attempt to understand what led to the relatively swift abandonment of the strategy and the difficulties that followed.

### Kodak's strategy was met with firm opposition

The shift from analogue to digital technology that Daniel Carp announced in 2003 was carried out in a rather standard way. Management decided to both close facilities and do away with businesses it no longer considered as having potential. Meanwhile, the company's strategic shift was mainly conducted through external growth operations. It is now a given that mergers and acquisitions can allow firms to access new resources and expertise that it would be too difficult and time-consuming to develop internally (Lehmann-Ortega *et al.*, 2016, p. 465). Through its acquisitions, Kodak sought to extensively update its business portfolio, resources and expertise with the aim of permanently changing the company's direction. This choice was all the more logical since Kodak was not keeping up with technological developments or with its competitors. However, changing direction in this way required huge financial resources, at a time when the company's debt was already enormous and its photography business appeared to have fairly low economic returns. Consequently, managers did not necessarily have many other options left. A significant dividend cut was then seen as a way to raise \$1.3bn over four years. The formation of a group of some 100 dissident shareholders and the opportunistic stake taken by Carl Icahn demonstrated to what extent this decision was problematic to the company's investors.

At the end of 2003, Kodak's situation was that the directly concerned by the strategy decisions and the means used to implement them had major leverage and opposed what had been decided. As shown by Newcombe's work (2003), the strategy must be

acceptable to this type of actor ("key stakeholders" in Newcombe's terminology), otherwise managers could find themselves in a situation with no resolution. So, quite logically, Kodak's leaders were going to make it their priority to retain these stakeholders' support. The strategy adjustments made starting in December 2003 can be considered as a way of regaining the support of disgruntled shareholders. This "reworked" strategy was no longer about dropping the film business, but about attempting to continue to exploit the potential of analogue technology in order to ensure the growth of digital technology. The reasons for this decision may have been based on certain figures showing that film was declining fairly slowly in western markets and growing in some other markets, like China.

The fact remains that this reworked strategy was fundamentally a response to shareholder pressure. When management confirmed in early 2004 that it would continue to sell film products in eastern Europe, Latin America and India, a spokesperson for the company said that its goal was to "focus our film investments on opportunities that provide faster and attractive returns" (*The Guardian*, 14/01/2004). This statement was undoubtedly directed at shareholders concerned about short-term profitability. Simultaneously, job cuts continued, enabling Kodak to save \$1bn a year. Managers incorporated the two major demands from the dissident shareholders' counter proposal: seeking out cost-cutting measures and leveraging the company's dominance in film photography. It is also worth noting that from late 2003 to early 2004, Kodak's share price rose significantly, and even jumped 12% in January 2004 (see Figure 1).

The results of this revised and corrected strategy, which consisted of maintaining a balance between the company's old and new businesses, would turn out to be disappointing. Projections about the potential of various markets were wrong. First of all, film sales for the years 2005-2006 dropped by 30% a year, which was faster than expected, as management had projected an annual decline of 5%. Secondly, the assumption that Kodak sales would grow in emerging markets was not borne out.

### Handling conflicting demands was an impossible task

Strategic management is known to be a complex process involving not just a single solution, but multiple options that reflect conflicting demands. Gérard Kœnig (1996) put forward the "security, legitimacy and competitiveness" triangle as a representation of these demands. Managers must ensure both the firm's competitiveness (its ability to withstand comparison with competitors to build and retain a customer base) and security (ensuring the firm's survival and cohesion). But they also must be able to explain the reasoning behind their decisions, particularly to boards of directors and shareholders, which relates to legitimacy.

All the complexity of the strategic management process lies in the difficulty of reconciling these three demands at once, and Kodak's case demonstrates this anew



(Tellier, 2014). Management's initially planned strategy unquestionably conveys competitiveness-related demands. The industry experienced a technological disruption, the company fell behind in exploiting digital technology and became surpassed by competitors. Adapting was imperative if it hoped to be number one in the world again. But to navigate this shift as best as possible, the company would have to let go of its traditional businesses and ramp up its investments. If it were to fail, its very survival would be in jeopardy. The company's security would be threatened if profitability were to be deemed inadequate and debt huge (it was roughly \$3bn in 2003). These risks were highlighted by ratings agencies when they decided to downgrade Kodak's long-term debt rating. There were, as we can see, conflicting tensions between competitiveness- and security-related demands.

However, a "competitiveness/legitimacy" paradox can also be identified. A decision is said to be legitimate when it is considered fair and desirable. Koenig (1996) notes that legitimacy is directly related to a firm's stated mission. Daniel Carp sought to restore Kodak's position as number one in the world, but this time in the digital photography market. Nonetheless, a number of analysts stressed that the company was highly unlikely to reach in the digital space the dominant position it had occupied in its traditional businesses and have the same levels of profitability. Yet, clearly, for many, Kodak's primary objective was to maximize shareholder value. It is important to note that Kodak shares had long been considered "high-yield securities" by Wall Street. Its successive managers favored a very generous dividend payout policy and, in 2002, Kodak shares were still the most "attractive" on the Dow Jones with 66% of the net profit distributed to shareholders. The dividend cut decided in 2003 was therefore unprecedented in the company's history. Furthermore, many analysts highlighted the fact that it was the first time since 1902, when Kodak paid out its first dividend, that such a decision had been made. It is readily apparent that the "180° shift" strategy devised by managers to ensure competitiveness suffered from a substantial legitimacy deficit from the outset, due to how they chose to proceed with it.

When the strategy was announced in September 2003, Kodak's managers believed they had plenty of leeway to force through such a dividend cut. For one, share ownership was highly fragmented; the main shareholder (the mutual fund Legg Mason) owned "as little as" a 4.5% stake (the tenth-largest Kodak shareholder then owned a shareholding of less than 0.7%). In this situation, the stakeholders most affected by the cut had relatively little power. However, the formation of a group of some 100 dissident shareholders would shift the balance of power. Controlling 25% of Kodak shares, the group could exert pressure on management to compel them to negotiate and ultimately push them to amend their initial strategy. The focus of the strategy was then changed and no longer about dropping the film business, but about continuing to exploit its potential in order to ensure the growth of digital technology. As we have seen previously, these adjustments were generally well received by the financial community.

Managers ultimately suggested significant changes to the initial strategy, probably in order to make up for a legitimacy deficit and to find a solution to the "legitimacy/competitiveness" paradox, coming up with the "transition" strategy which was based on a very gradual withdrawal from film photography. However, the assumptions on which the strategy was based were not borne out.

## Discussion and conclusion

Our paper seeks to revisit Kodak's collapse, which occurred in connection with the growth of digital technology. The analysis we conducted prompts us to qualify the widely circulated assertion in the literature according to which the company's managers fell victim to disruption, a concept popularized by Christensen.

### Factors behind Kodak's strategy going unimplemented

Following his appointment as CEO of Kodak in 2000, Daniel Carp seemed persuaded of the need to embrace digital technology. Back then, two-thirds of the company's R&D investments were allocated to this technology. This unprecedented effort would go on to enable Kodak to build an impressive digital patent portfolio, one that would be sold off incrementally to avoid bankruptcy. Weissmann (2012) reminds us that Kodak made just under \$2bn "between 2008 and 2010 through licensing and litigation over its IP [intellectual property]". This is further proof of the resources the company had developed in the digital arena.

The strategy devised in 2003 thus attests to Kodak's desire to operate a major technological shift, but this particular strategy was never actually implemented. As we saw before, the positions of various stakeholders and, most notably, the dispute with shareholders, prevented the strategy developed by Mr Carp and his team from being implemented. If we wish to understand why the Rochester-based giant went bankrupt, we have to take into account all factors, such as the company's shareholder structure, initial financial state and failed "reworked" strategy.

On this point, our conclusions support and add to the findings of Benner (2010), who analyzed the reports on Kodak written by securities analysts from five investment banks (Morgan Stanley, Prudential, Salomon-Smith Barney, Paine Webber and Crédit Suisse First Boston) over the 1990-2001 period (*i.e.* prior to the 2003 strategy). Benner's research shows that during this span of time that ushered in digital technology and the beginning of the decline of film photography, analysts' reports generally contained positive statements about Kodak. They mainly focused on Kodak's legacy business (mentioning film photography 2,821 times) and perceived managers' decisions to cut costs as appropriate. By contrast, analysts mentioned digital technology much less often (only 158 times) and were often critical of managers' first digital initiatives. Barthélemy (2016, p. 135) draws attention to the conclusions of one Prudential analyst that perfectly distil the financial



community's initial reluctance towards Kodak's entry into digital photography and the importance accorded to shareholder interests: "[TRANSLATION] We are curious to see how shareholders are going to react when they realize how much money is being wasted on digital. What nonsense!"

In Barthélemy's view, such a comment is characteristic of the priority financial analysts give to strategies that maximize short-term profitability and underscores just how difficult it is for management to convince stakeholders to accept a strategy that breaks with past decisions. The challenge was all the greater for managers of a company with a history of paying out very generous dividends.

### The impact of shareholder activism on disruptive innovation

Our analysis highlights the role played by shareholders in rejecting Kodak's initial strategy and developing a transition strategy which would allow the company to continue to leverage its legacy business model centered on film photography. Two points are worth being made here.

Firstly, Kodak can be considered as a typical case of shareholder-value-oriented governance. In 2007, 91% of the company's shares were held by institutional investors and investment funds (at that time, its ten largest shareholders were funds known for their activism, including Legg Mason Value Trust, Templeton Value Fund, Fidelity Value Fund and Vanguard/Prime Cap Fund). Nevertheless, as the Notat-Senard report (2018, p. 19) asserts, shareholder-value-oriented governance and the resulting short-termist thinking have a negative impact on R&D investments and innovation (Brossard *et al.*, 2013). In the same vein, Asker *et al.* (2015) found that listed firms in the United States invest less than their unlisted counterparts and that listed firms with more institutional investors invest less than other listed firms.

Secondly, during the study period, Kodak's management was faced with strongly activist legacy shareholders as well as the corporate raider Carl Icahn. Our study shows that strong opposition from these powerful stakeholders led managers to be overly preoccupied with their expectations. These findings are consistent with those of Antioco (2011), who found that the failure of Blockbuster, the DVD rental giant facing the rise of Netflix, was due to opposition from activist shareholders. Similarly, a study carried out by Desjardine and Durand (2020) on hedge fund activism demonstrated how these types of stakeholders prioritize short-term returns and profitability.

Our work thus underscores the conflicting imperatives of responding to a disruptive innovation with an appropriate strategy (which involves a change in technology and business model) and meeting certain shareholders' expectations. However, it must be said that the impact of shareholder activism on innovation is still poorly understood. The findings of the few research studies that have been conducted were consistent with our observations. A study by Brav *et al.* (2018) on activist hedge

funds (like Carl Icahn's) shows that target firms' R&D spending tends to drop, along with their R&D-related assets, and that a favored strategy is to refocus firms towards their core expertise. Vacher *et al.* (2020) reach similar conclusions, as they observe that hedge funds push mature firms to refocus on their core expertise (in Kodak's case, film photography).

However, these studies do not astutely touch on the types of innovation in question (particularly the distinction between disruptive and sustaining innovation) and concentrate on R&D investments and patent filings to measure innovation efforts. Clearly, our case study calls for future research to better understand the impact of shareholder activism (and more broadly the financialization of the economy) on disruptive innovation strategies. Kodak's case shows us that managers of certain large established firms must face conflicting demands: they have to highlight the innovation efforts their firms have undertaken in order to reassure the financial community as to their competitiveness in today's fast-moving environment, while being careful to preserve shareholder value.

### A call for proceeding with "caution" when using cases in point

Our analysis demonstrates the importance of taking into account governance issues when examining management-level decisions regarding innovation. These aspects have not been covered in the literature on disruption, particularly in analyses of Kodak's collapse. Yet, already in 1989, Baden-Fuller signaled the significance of conflicts between managers, shareholders and creditors in gaining acceptance for and ensuring the success of attempts to transform, especially in undiversified firms.

Accordingly, this reinterpretation of Kodak's collapse should prompt caution in using "cases in point" to illustrate or support theoretical approaches. Our aim of maintaining a very fine "level of granularity" in this study allowed us to identify factors that had hitherto gone unnoticed.

In qualitative research, the risk of circularity (Dumez, 2013, p. 17) is often high. Whereas the material collected by the researcher is diverse and inevitably incomplete, the theories underpinning the work are general and decontextualized. This being so, the researcher can, even unconsciously, select data that confirms the theory and set aside all data that could lead them to nuance their position. We have attempted to avoid this circularity bias by establishing a detailed chronology of events without using a pre-determined theoretical framework.

Our analysis does not call into question the value of Christensen's work or, more broadly, research that highlights the dangers threatening management teams having to confront rapid and far-reaching changes in their business environment. In particular, the work of Silberzahn (2014a and b) clearly demonstrates the business model incompatibility issues facing a firm undertaking a technological transition. Other case studies have also demonstrated the explanatory value

of Christensen's theory and the useful advice it offers for managers (such as Intel's launch of the Celeron family of processors: Ben Mahmoud-Jouini and Silberzahn, 2016). Moreover, it is naturally impossible to ascertain whether the 2003 strategy would have been successful. The fact remains that it is problematic for certain explanations for a firm's success or failure to be circulated rapidly and widely. Kodak has become such a famous "case in point" that it is sometimes used in an oversimplified way to discuss the dangers of disruption and how to avoid them.

The findings conveyed in this paper should serve to remind us of the limitations of explanations of the "it's as if" sort. Indeed, a swift interpretation of Kodak's decline could lead one to believe that the managers seemingly had fallen victim to the mechanism of disruption described by Christensen and his disciples. Our analysis shows that the company's decline was also due to causes that are not covered in the author's work. Rosenzweig (2009) has sounded the alarm on the tendency we can have to infer one or another specific characteristic based on a general impression, and the Kodak case is a fresh reminder of this. How established firms can/should respond to technological disruptions is a highly complex question, but the challenge of the researcher who moves to reconstruct and understand these responses is to confront complexity and avoid succumbing to the temptation of a "ready-made" explanation.

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# Mosaïque

« Alors, heureux ? »

À propos de l'ouvrage de Luc Ferry,  
*La Frénésie du bonheur*, Paris,  
Éditions de l'Observatoire, 2023

Par Antoine MASINGUE

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Luc Ferry, ancien ministre de l'Éducation nationale, professeur des universités, agrégé de philosophie et de science politique, nous est revenu l'automne dernier avec un essai stimulant, intitulé *La Frénésie du bonheur* (Éditions de l'Observatoire, 2023), dans lequel il s'interroge sur l'individualisme exacerbé qui règne dans nos sociétés occidentales et sur ses conséquences sur le devenir de notre civilisation.

Dès l'introduction de l'ouvrage, le propos est décapant :

« [Dans] un sondage de l'Ifop réalisé en 2022 auprès des salariés [...], la question posée était la suivante : "Que préférez-vous : avoir plus de temps libre ou une rémunération meilleure ?" En 2008, 62 % des salariés préféraient travailler plus pour gagner plus et 38 % souhaitaient l'inverse ; en 2022, 61 % voudraient travailler moins quitte à gagner moins et 29% seulement avoir un meilleur revenu en travaillant plus. Question simple : que s'est-il passé entre 2008 et 2022 pour qu'une telle inversion de tendance devienne aussi rapidement possible ? Réponse : la pandémie [...] qui a permis à de nombreuses personnes à réfléchir sur le sens de leur vie » (p.10).

Mais, de manière plus globale, nous précise Luc Ferry :

« [J]e suis convaincu que nous vivons un changement d'époque, une faille de civilisation dont la "grande démission" (*big quit*) et la "démission tranquille" (*quiet quit*), comme disent les 50 millions d'Américains qui ont dénoncé leur contrat de travail pendant la pandémie, mais plus encore, en arrière-fond de ces démissions, la quête frénétique du bonheur personnel, l'éloge déculpabilisé du narcissisme et du souci de soi au détriment du bien commun et du souci des autres sont les symptômes les plus profonds » (p.11).

Pour Luc Ferry, nous vivons une rupture civilisationnelle sans précédent marquée par la déconstruction des grands récits sacrificiels (christianisme, nationalisme, marxisme) qui nous promettaient le bonheur dans l'au-delà (le paradis) ou dans une société à faire advenir. Dans ces récits, le destin des individus était adossé à des entités (Dieu, la Nation, la Révolution), transcendantes, c'est-à-dire extérieures et supérieures à eux.

L'espoir d'une vie meilleure dans un avenir radieux, céleste ou terrestre, est désormais aboli. Ne reste plus que le présent comme seul horizon : le bonheur doit être dans « l'ici et le maintenant ». L'atteinte du bonheur individuel semble désormais l'idéal à atteindre, le *leitmotiv* d'une vie bonne. Nous sommes passés d'une acceptation d'un bonheur différé à celui de l'exigence d'un bonheur immédiat. Et ce passage affecte notre relation aux grandes dimensions de l'existence : rapport à nous-même (le souci de soi devient prioritaire et le souci de l'autre n'intervient que s'il améliore notre propre bien-être, dans une optique purement utilitariste), rapport au travail (puisque nous n'avons qu'une seule vie, inutile de la perdre à la gagner), rapport à l'éducation (il s'agit de privilégier le bien-être et l'épanouissement de l'enfant en mettant au second plan, voire en rejetant, discipline, quête de l'excellence et respect de l'autorité), rapport au réel (il devient possible de vivre des vies rêvées dans des univers virtuels, des métavers, ou en s'adonnant au tourisme de bien-être, comme en atteste l'essor spectaculaire des croisières et séjours de *wellness*).

## L'argumentaire de Luc Ferry

Ce déclin des grands récits, selon Luc Ferry, est le fruit d'un double mouvement chargé de paradoxe : celui de l'émergence du capitalisme et de la mondialisation libérale, d'une part, et du développement de la « Pensée 68 », libertaire et bohème, prolongée par l'argumentation « déconstructionniste », d'autre part.



Le capitalisme d'innovation et d'hyperconsommation et le « gauchisme culturel » (l'expression est de Luc Ferry...) ont en effet pour point commun de percevoir « les valeurs et les autorités traditionnelles, celle des principes qui impliquaient, par-delà le souci de soi, un souci du bien commun et de l'intérêt général » (p. 97) comme étant des carcans, des freins à l'émancipation individuelle et à la libération des pulsions<sup>1</sup> (pulsions d'achat ; pulsions créatrices, pulsions vitales) ce en quoi elles se rejoignent, dans leur volonté de déconstruire l'ordre ancien, incarné par les grands discours sacrificiels.

Notre société a ainsi donc érigé le bonheur individuel en *alpha* et en *omega* de la vie bonne, de la vie réussie. En témoignent, notamment, l'immense succès des auteurs d'ouvrages de développement personnel et de psychologie positive qui, à longueur de pages, mettent en avant l'importance du souci de soi et nous enjoignent, pour paraphraser l'un d'entre eux (Fabrice Midal<sup>2</sup>), à « devenir plus narcissiques ». Et ce, à force de références hétéroclites (le mythe de Narcisse revisité, le stoïcisme, Bouddha, Spinoza, des études scientifiques non identifiables) mobilisées pour impressionner le lecteur, mais souvent développées de manière approximative, quand ce n'est pas sur le mode du contre-sens. Pour Ferry, ces auteurs confondent souci de soi et égoïsme pur et simple, et s'inscrivent dans une tradition utilitariste originaire du monde anglo-saxon (fondée par le philosophe Jérémy Bentham au XVIII<sup>e</sup> siècle) et caractéristique du capitalisme libéral (le souci de l'autre n'est envisageable que sous l'angle de calculs coûts / avantages).

Ferry fulmine contre ce mouvement de fond, qui, de manière frénétique, imprègne nos sociétés occidentales. Reprenons quelques points de la trame de son argumentation.

Tout d'abord, poser le bonheur comme objectif de vie semble bien chimérique. En effet, la notion même de bonheur est difficile à définir (« une éternité de joie » selon Spinoza, *i.e* un état de satisfaction globale et durable). Selon Kant, dans *Fondements de la métaphysique des mœurs* (1785), « le concept de bonheur est un concept [...] indéterminé [...] Le bonheur est un idéal, non de la raison, mais de l'imagination ». S'il est facile de déterminer ce qui nous rend malheureux (deuils, souffrances, maladies...), il semble bien difficile de donner une définition universelle du bonheur, par essence subjectif.

D'autre part, ces « penseurs du bonheur » s'inscrivent tous, et généralement de façon très revendiquée, notamment en se référant au spinozisme ou au stoïcisme, dans une vision déterministe, essentialiste et « présentiste » du monde : il convient d'accepter

<sup>1</sup> Luc Ferry, pastichant Herbert Marcuse, parle d'un processus de « désublimation répressive » : en référence à « ce que Freud désignait comme le processus de "sublimation", en substance la création de valeurs religieuses, morales, esthétiques et spirituelles, (qui) calmait la libido et freinait par là-même le désir incessant de consommer toujours plus » (p. 114).

<sup>2</sup> Midal F. (2022), *Soyez narcissique et sauvez votre peau*, Paris, Flammarion, 2018.

le monde tel qu'il est et de se « réconcilier avec lui » en changeant les représentations que l'on en a, de « savourer le moment présent ». Il revient à chacun de connaître sa « nature profonde » et de faire les choix qui correspondront le mieux à son essence, afin d'atteindre le bonheur.

Ferry s'érige contre cette position : il en appelle aux philosophes de la liberté, qui considèrent que ce qui caractérise l'humain est justement le fait de disposer d'une liberté qui lui permet de s'émanciper des déterminismes naturels, et ce dans une optique de perfectibilité et de progrès (par la politique, l'éducation et la culture).

Comme le dit Ferry :

« [T]elle est du moins la thèse, à mon sens juste et lucide, qui apparaît déjà dans le mythe de Prométhée tel que Protagoras nous le raconte dans le dialogue de Platon qui lui est consacré, une thèse d'une rare profondeur qui sera reprise, développée et conceptualisée plus tard dans les philosophies de la liberté depuis Pic de la Mirandole, Rousseau et Kant jusqu'à Husserl, Sartre et même Heidegger. On y comprend enfin pour quelles raisons l'essence de l'homme est de ne pas avoir d'essence, sa nature de ne pas avoir de nature, car c'est en cela que réside sa liberté qui engendre une double historicité dont il fait preuve, à la différence des animaux : historicité de l'éducation tout au long de sa vie au niveau individuel, historicité de la culture et de la politique au niveau collectif » (p. 158).

Et il ajoute :

« [J]e pense [...] que la sagesse, mais avec elle tout simplement la dignité humaine, commence le jour où on est capable de dire "non" au réel, non à l'injustice et à l'ignominie, ce qui suppose qu'on ne se résigne jamais, qu'on n'accepte jamais l'inacceptable, qu'à l'image d'un Churchill ou d'un de Gaulle, on refuse de se coucher devant l'abjection, un refus qui n'a aucun sens dans le déterminisme dogmatique d'Épictète ou de Spinoza » (p. 74).

Enfin, Luc Ferry assène le coup fatal : la quête du bonheur rend ceux qui s'y livrent profondément malheureux :

« [S]elon un processus qu'on pourrait dire "dialectique", la thèse eudémoniste se transforme alors en son contraire : un stress angoissant. En faisant miroiter aux disciples qu'ils peuvent s'en tirer par quelques exercices physiques et spirituels quotidiens, en leur laissant croire que "tout dépend d'eux", qu'ils sont capables d'améliorer leur vie en travaillant sur eux-mêmes plus que sur le monde extérieur, on finit par créer un idéal du moi si élevé qu'il en devient destructeur » (p. 171).

Au final, Luc Ferry en appelle à la consécration de ce qu'il dénomme une « spiritualité laïque », c'est-à-dire un choix de vie où l'on considère que ce qui est sacré (*i.e.*, selon lui, « ce pour quoi on serait prêt à se sacrifier ») est l'amour de nos proches et l'état du monde que nous voulons transmettre à nos enfants.

Pour Ferry :

« [C]ontre le narcissisme et le bonheur érigé en but ultime et exclusif de l'existence humaine, la spiritualité laïque fait l'éloge de l'excellence et du travail bien fait, celui du don de soi et de l'esprit de sacrifice, de la sérénité et de la possibilité de la joie, plutôt que du bonheur, l'éloge, aussi, du bien commun et de l'intérêt général plutôt que du repli sur soi, et avant toute chose, celui de l'amour des autres et de l'altérité plus que l'amour de soi » (p. 366).

## Que penser de l'ouvrage de Luc Ferry ?

La dénonciation des mirages des idéologies du bonheur, opérée par Luc Ferry, semble salutaire et bienvenue. Son appel à l'esprit de résistance, à la réhabilitation de la liberté, du sens du travail, de l'action au service des autres et de l'intérêt général sont salutaires.

Le monde de l'entreprise est lui-même profondément affecté par ce mouvement de « bonheurisation » : en témoignent, par exemple, la multiplication des postes de *Chief Happiness Officer*, qui peut paraître édifiante. Nicolas Bouzou et Julia de Funès ont d'ailleurs fait une vive critique de cette tendance dans leur ouvrage *La Comédie (in)humaine* (2018)<sup>3</sup>, ainsi qu'Eva Illouz et Edgard Cabanas dans leur ouvrage *Happycratie* (2018).

Les détracteurs de Luc Ferry lui reprocheront son caractère néo-conservateur : le philosophe-ministre a des positions très tranchées, et il est, en effet, possible d'en débattre...

On peut aussi remarquer que la thèse qu'il soutient n'est pas très récente. Pensons, entre autres, à la « fin des grands récits » avancée par Jean-François Lyotard dans *La Condition postmoderne* (1979) ; pensons à Christopher Lasch et à *La Culture du narcissisme* (1979) ; ou plus récemment à Marie France Hirigoyen et son ouvrage *Les Narcisse* (2019)<sup>4</sup>. Évoquons

<sup>3</sup> Cet ouvrage a fait l'objet d'une recension dans la rubrique Mosaïques du n°134 (2019/1) de la présente revue.

<sup>4</sup> Cet ouvrage a fait l'objet d'une recension dans la rubrique Mosaïques du n°136 (2020/1) de la présente revue.

également l'ouvrage de Pascal Bruckner, *L'Euphorie perpétuelle : Essai sur le devoir de bonheur* (2000) ; ou encore les travaux du sociologue Alain Ehrenberg (par exemple *La Fatigue d'être soi : dépression et société* (1998)).

Enfin, certains lui reprocheront de parfois présenter une vision caricaturale de la psychologie dite positive : certaines des pratiques qu'elle déploie (notamment la méditation en pleine conscience) peuvent s'avérer très utiles pour soigner certaines souffrances psychiques, notamment les troubles anxieux. Et certains auteurs (notamment le docteur Christophe André) mériteraient sans doute plus de considération que celle que ne leur attribue Ferry.

Il n'est pas question ici néanmoins de raviver les tensions opposant parfois de manière virulente philosophes et psychologues, et nous laisserons Luc Ferry conclure :

« Là encore, pas de malentendu ni de mauvais procès, ce serait trop facile : nul n'en appelle pour autant au mépris, voire à la haine de soi. Les êtres qui se détestent eux-mêmes sont en général des dangers publics. Est-on pour autant obligé de passer de l'autre côté du cheval ? Entre se méfier de la haine de soi et s'aimer comme Narcisse, entre s'oublier au point de se maltraiter et "faire passer toujours ses besoins devant ceux des autres", tout individu doté d'un minimum de bon sens comprendra qu'il y a ce qu'Aristote appelait une "juste mesure", un moyen terme qu'il définissait, non comme une zone grise sans saveur ni couleur, mais au contraire une forme d'excellence » (p. 23).

## Pour essayer de comprendre l'incompréhensible Elon Musk

À propos de l'ouvrage de Walter ISAACSON, *Elon Musk*, Simon & Schuster, 2023, 688 p.

Par Guy MAUGIS  
AFNOR



« À tous ceux que j'ai offensés, je veux simplement leur dire que j'ai réinventé les voitures électriques et que j'envoie des gens sur Mars dans une fusée. Pensez-vous que j'allais aussi être un être froid et normal ? »  
Elon Musk, 8 mai 2021

« Ceux qui sont assez fous pour croire qu'ils peuvent changer le monde sont ceux qui le font. »  
Steve Jobs

Deux citations en ouverture de la remarquable biographie d'Elon Musk par Walter Isaacson, déjà renommé pour ses ouvrages sur Steve Jobs, Benjamin Franklin ou Henry Kissinger, plantent le décor. Qu'il fascine ou qu'il révulse, Elon Musk est à l'origine de grandes start-ups (PayPal, SpaceX, Tesla, Starlink, OpenAI,

Optimus, The Boring Company, Hyperloop, Neuralink) et à la tête de Twitter (X), qui marqueront le XXI<sup>e</sup> siècle. Les 650 pages de cette biographie très complète et détaillée, que nous offre Isaacson, demeureront sans doute un témoignage unique dans l'histoire de l'industrie. Enrichie par plus d'une centaine d'interviews de proches et de collaborateurs, et témoignant directement de dizaines de réunions de travail, elle nous livre un tableau précis et sans concessions des méthodes de travail d'Elon Musk.

Le lecteur en sciences de gestion pourra regretter que plus de la moitié de l'ouvrage soit consacrée à l'enfance de Musk et à ses frasques familiales et sentimentales, un aspect plus proche d'un magazine *people* que d'un manuel de gestion. Cependant, cela participe à la compréhension – ou à l'incompréhension – du personnage. Avec ses onze enfants, ses trois mariages et ses nombreuses aventures, Musk incarne aussi un côté glamour, avec son amour des fêtes débridées, du Met Gala au Burning Man.

Par contre, les 250 à 300 pages dédiées aux activités professionnelles de Musk sont riches en détails, anecdotes et quasi comptes rendus de réunions, et plus proches des méthodes d'observation des sciences sociales que du roman. La narration des actions permettant à Musk de réaliser en un mois ce que d'autres peinent à accomplir en un an, ou de diviser par dix les coûts de production là où les *leaders* de l'industrie se contentent de 10 %, offre un matériau brut pour comprendre l'incroyable succès de cet entrepreneur. Ce récit invite également à s'interroger sur un style de management brutal, inhumain pour lui comme pour ses subordonnés, mais générateur d'une fierté incomparable chez ceux qu'il pousse à dépasser leurs limites.

Quelques principes de management appliqués par Musk, avec une obsession notable, méritent d'être soulignés (cf. « Faut-il être obsessionnel pour être un bon patron ? Un cas : Louis Renault », M. Berry et P. Fridenson, *Gérer & Comprendre*, n°18, mars 1990) :

- « L'idiot index » : calculé en divisant le prix d'achat d'une pièce par le coût des matières premières incluses. Si ce ratio est supérieur à 2, la pièce est mal conçue, trop complexe, mal fabriquée ou le fournisseur pratique des prix absurdes. Musk exige de tous ses ingénieurs et chefs de projets de connaître les « idiot index » de toute la nomenclature des objets qu'ils fabriquent, que ce soit une voiture ou une fusée, et bien sûr de travailler sans relâche pour les réduire.
- Questionner toutes les spécifications par la méthode des « pourquoi ? ». Si la réponse est « c'est dans le manuel de la Nasa » ou « on a toujours fait comme ça » ou encore « tout le monde sait bien que », celui qui l'a donnée a peu de chances de survivre à la réunion. La bonne méthode : celle de l'essai-erreur. Si ça casse, c'est que c'est sous-dimensionné. Les seules spécifications incontestables sont les lois de la physique. Application pratique sur les fusées Falcon : de l'acier inoxydable plutôt que du titane.



Finalement, cela tient et on obtient un facteur 10 sur les coûts.

- Le bon sens jusqu'au bout : ce qui coûte une fortune dans le lancement d'un satellite, c'est le fait de jeter le lanceur à chaque fois. On ne jette pas un train ou une voiture après chaque utilisation. Il faut donc des fusées réutilisables. Après une dizaine d'échecs instructifs, SpaceX est aujourd'hui la seule entreprise au monde à maîtriser cette technologie, lui conférant un avantage de coût indéniable. Partie de rien en 2001, SpaceX effectue actuellement trois lancements par semaine, représentant plus de la moitié des lancements mondiaux.
- Questionner les méthodes de fabrication : un matin, il observe que le châssis du véhicule miniature de son fils est fait d'une seule pièce en aluminium moulé. Les châssis des Tesla, comme ceux des autres constructeurs automobiles, sont alors faits de centaines de pièces embouties et soudées. Après cette « simple » constatation, et un aller-retour dès le lendemain chez le fabricant italien des plus grandes presses à injection, les châssis des futures Tesla seront réalisés à partir de trois pièces moulées dans les « giga-presses ».
- Simplifier les structures hiérarchiques : éviter les réunions, aller directement sur le terrain et court-circuiter la hiérarchie pour comprendre. D'où les nuits passées avec les ouvriers pour déceler les goulots d'étranglement ou grappiller quelques secondes de temps de cycle sur les machines.
- L'urgence comme moteur, et l'art de la débrouille : pour déplacer les serveurs d'un centre de calcul – une opération que les experts estimaient nécessiter un transport spécial et plus d'un mois de délai –, Elon Musk prit une clé, démontra puis remonta un serveur pour en vérifier le bon fonctionnement, puis loua tous les camions Hertz de la région et réalisa le transfert en un week-end.
- Rapprocher l'ingénierie de la production : mettre les concepteurs dans l'usine pour éviter qu'ils dessinent des pièces impossibles à fabriquer.
- Et surtout, ne jamais accepter le mot « impossible » : les seules véritables limitations résident dans les lois de la physique et la sécurité des personnes.

Ces méthodes de travail sont assez classiques et duplicables, proches du *Design to cost*, des questionnements du *Lean manufacturing* ou du *Go to Gemba* de la méthode Toyota. Ce qui fascine dans le récit d'Isaacson, c'est l'intransigeance et l'inflexibilité avec lesquelles Musk applique ces principes.

Robert Bosch disait : « Je dois plus mes succès à mon caractère qu'à mes connaissances ». Si Elon Musk s'intéresse de près à la science et à la technique, c'est surtout dans son caractère unique et son opiniâtreté que l'on entrevoit les raisons de ses succès. Personne ne pourra copier cette combinaison unique d'un syndrome d'Asperger, le rendant incapable de la moindre empathie, et d'une enfance maltraitée, le poussant vers des expériences extrêmes. Les souffrances

infligées par son père ont sans doute forgé ce trait de caractère, mais aussi développé un goût du risque peu commun. Il est intéressant de lire comment la prise de risques, jugés insensés par les experts, a permis de développer en cinq ans, avec 500 personnes, un lanceur performant et réutilisable, là où la Nasa et Boeing n'y parviennent toujours pas après quinze ans et 50 000 ingénieurs, qui ne bougent qu'après avoir tout validé et contrôlé trois fois. Ceinture et bretelles contre risque insensé !

C'est sans doute ici que réside aussi toute la fragilité du personnage et de ses entreprises, qui reposent uniquement sur lui :

- Un amour quasi maladif du risque et une complaisance à se mettre en situation de crise ou d'urgence : l'adrénaline comme une drogue. La dépression quand tout va bien. L'impossible comme seul stimulant.
- Créer l'urgence pour accélérer sans cesse.
- Un manque total d'empathie envers ses collaborateurs, qu'il traite avec mépris. Il n'hésite pas à licencier en une minute des collaborateurs fidèles et efficaces depuis plusieurs années.
- Rappeler des collaborateurs ayant déjà passé quatre jours sans dormir une nuit de Noël pour régler des problèmes pas vraiment urgents, mais pour « garder le rythme ».
- Jamais de félicitations, mais toujours « si tu n'es pas capable de le faire en une semaine, je trouverai quelqu'un demain pour te remplacer ».
- Mais aussi un management par l'exemple : le sac de couchage au bout de la ligne d'assemblage et trois heures de sommeil par jour pendant la montée en cadence de l'usine de Fremont en 2016.
- Et bien sûr, une hyper-centralisation.

En peu de mots, le contraire du management « bienveillant » souvent prôné aujourd'hui. Ce style impitoyable rappelle celui d'Harold Geneen, qui fit d'ITT une des plus grandes entreprises américaines à la fin des années 1970, tel qu'il le décrit lui-même dans son autobiographie : *Managing* (Harpers Collins, 1985). Mais ITT n'a pas survécu à son départ...

Il est aussi intéressant d'entendre plusieurs collaborateurs, qui ont quitté SpaceX ou Tesla, épuisés, écœurés par le manque de reconnaissance d'Elon Musk ou simplement licenciés en cinq minutes après cinq ans de bons et loyaux services couronnés de succès indéniables. Mais qui reviennent quelques années plus tard, victimes d'une sorte de syndrome de Stockholm, déclarant s'ennuyer dans toute entreprise « normale » incapable de tirer le meilleur d'eux-mêmes, et bien au-delà, comme seul Elon Musk avait su le faire.

On ressort de cette lecture abasourdi et perplexe, oscillant entre admiration et effroi. Le management inhumain est-il le seul qui puisse aujourd'hui assurer un tel succès ? Comment gérer efficacement, avec un style de management aussi personnel et une telle implication, autant d'entreprises différentes ? Quelle



sera la prochaine folie qu'il va inventer après avoir posé des hommes sur Mars, fait marcher les paralytiques avec Neuralink, soulagé le travail pénible avec les robots d'Optimus ou relié Los Angeles à San Francisco en une heure avec Hyperloop ? Twitter (X) est-elle l'aventure de trop, l'engloutissant dans des questions éthiques et politiques dont les réponses sont plus incertaines que celles des lois de la mécanique ? Où va-t-il disparaître d'une overdose, entraînant ses entreprises dans sa chute ?

## La science aujourd'hui

À propos de l'ouvrage d'Alain Prochiantz, **Accident. Regard sur la République des sciences**, Paris, Odile Jacob, 2024

Par Hervé DUMEZ

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Neurobiologiste, membre de l'académie des sciences, professeur émérite au Collège de France, Alain Prochiantz fait, par accident (d'où le titre du livre), en 1989, une découverte fondamentale allant contre tout ce qui est généralement admis dans sa discipline. Il continue ses recherches dans une voie plus classique, mais, protégé par un professeur et administrateur du Collège de France, il lui est permis de poursuivre dans la direction la plus révolutionnaire, sans avoir à publier durant quelques années. Ceci, pense-t-il, ne serait plus possible aujourd'hui.

Comme le montre un article paru récemment dans *Nature* (Park *et al.*, 2023)<sup>1</sup>, l'intérêt réel des publications

<sup>1</sup> PARK M., LEAHEY E. & FUNK R.J. (2023), "Papers and patents are becoming less disruptive over time", *Nature*, vol. 613, n°7942, pp. 138-144.

scientifiques, comme des brevets, qui connaissent pourtant les uns et les autres une croissance exponentielle, est dramatiquement en baisse. Mécanismes de financement, de fonctionnement des revues, d'évaluation, tout concourt à une telle situation.

Les financements, tout d'abord, ne se portent pas sur des sujets risqués, mais sur des choses déjà faites ou très peu risquées :

« [...]Les prospectus des agences de financement de la recherche qui, à travers leurs appels d'offres, organisent la compétition entre équipes pour l'attribution des contrats, ne manquent jamais de spécifier que seront favorisés les projets risqués : "high risk - high gain". Une plaisanterie quand, sous la démonstration demandée de "faisabilité" du projet, se dissimule la nécessité d'avoir déjà accompli une partie importante du travail pour lequel le financement est sollicité » (*op. cit.*, pp. 26-27).

Les grandes revues, quant à elles, sont frileuses envers ce qui touche à la nouveauté. Lorsque la découverte a été faite par Alain Prochiantz, l'équipe a cherché à publier. Elle a reçu de la part d'un *reviewer* anonyme ce commentaire :

« Ne doit être publié sous aucun prétexte, ni dans ce journal ni dans aucun autre » (*op. cit.*, p. 25).

Comme l'a montré Jeffrey Brainard<sup>2</sup>, pour publier dans une revue reconnue, mieux vaut être connu des éditeurs et des *reviewers* (qui peuvent assez facilement savoir qui vous êtes).

Sur le plan de l'évaluation :

« [U]ne [...] évaluation "haute couture" exigerait que soit pris le temps nécessaire pour lire les articles et pas seulement les compter, comprendre les projets et en discuter sur le fond. Qu'un comité débarque, reste deux jours pour inspecter, à la va-vite, un grand nombre d'équipes, puis reparte après avoir tranché dans le vif, cela est malsain » (*op. cit.*, p. 75).

Les instruments de gestion, quant à eux, induisent des stratégies ayant des effets délétères :

« Pour gonfler son "facteur H", il est plus profitable de publier un grand nombre d'articles suffisamment dans le "consensus" pour être cités rapidement par un maximum de collègues. Un adepte de la gonflette qui aura publié 800 articles à l'âge de 60 ans, soit plus d'un article par mois depuis sa naissance, sera mieux noté qu'un collègue à la tête d'une dizaine d'articles de très haut niveau. Illustration : le "facteur H" d'Alan Turing qui a seulement publié cinq articles – mais quels articles – est de 5 » (*op. cit.*, pp. 156-157).

Auparavant, les jeunes pouvaient explorer, mûrir leur question de recherche, simplement lire sérieusement :

« [...]Cette course éperdue, nez sur le guidon, interdit de s'attarder sur l'histoire de nos disciplines, voire de lire des pans entiers de la littérature scientifique contemporaine, activités essentielles à la formation de l'esprit scientifique, sans parler du loisir de flâner intellectuellement et d'entretenir un dialogue intérieur auquel peuvent s'inviter des savants amis, depuis longtemps disparus » (*op. cit.*, pp. 79-80).

Est-il encore possible de faire évoluer les choses ? Alain Prochiantz évoque deux pistes.

<sup>2</sup> BRAINARD Jeffrey (2022), "Reviewers award higher marks when a paper's author is famous", *Science*, vol. 377, n°6612, p. 1251.

Sur une évaluation de type Shanghai, les équipes se répartissent selon une courbe de Gauss. Il est inutile d'évaluer la majeure partie des centres de recherche, qui sont bons. L'évaluation doit porter, selon l'auteur, sur les équipes qui ont la note la plus basse et celles qui ont la note la plus élevée. Les premières peuvent être soit vraiment mauvaises, soit développer des projets originaux et ambitieux qui demandent du temps et du soutien. Les secondes, les mieux classées, peuvent être réellement excellentes, ou pratiquer la gonflette, c'est-à-dire publier « par an plus d'articles que leurs auteurs ne peuvent en lire, même si, par le biais de connexions sociales très efficaces, ce peut être dans d'excellents journaux » (*op. cit.*, p. 86).

L'autre piste concerne les mécanismes de publication, et l'auteur évoque une revue, *e-Life*, fonctionnant sur des principes différents. Les propositions sont évaluées par les éditeurs sur la base d'un critère : sont-elles prometteuses ou non ? Si elles le sont, elles sont envoyées à des *reviewers* et seront de toute façon publiées, quand les auteurs le décideront, avec les commentaires et les réponses à ces commentaires. Tout système a ses faiblesses, et, comme le note l'auteur, ici tout dépend de la qualité des éditeurs, de leur ouverture et de leurs compétences.

Pour ceux qui ont une formation en biologie, le livre comporte nombre d'éclairages originaux. Pour ceux qui s'intéressent au devenir actuel et futur de la science, il constitue un élément de réflexion important.

# FOR OUR ENGLISH-SPEAKING READERS

## OVERLOOKED

**Overstaffing: Cost to be reduced, or slack to be encouraged?**

**Stéphane Deschaintre & Salomon Bernier-Khedache.**

Overstaffing is commonly seen as a cost that should be reduced. However, our research, based on two industrial cases, presents company managers who advocate it. To analyze this counterintuitive result, we use the concept of organizational slack. The arguments of the managers are then structured around functions of organizational slack: Overstaffing allows them to prepare for the future and to preserve their employees. Showing overstaffing as a slack to be favored is unusual in the present context, and questions more broadly the widespread representations of a workforce that must necessarily be reduced. Our research also sheds light on the concept of organizational slack by showing that it can be consciously rationalized by managers, and therefore be part of a reasoned managerial logic.

## TRIAL BY FACT

**Story of a gradual decline of maintenance skills in a high-risk organization (1980-2020)**

**Léna Masson & Anne Dietrich.**

In industry, maintenance work, which is deemed non-strategic, is widely subcontracted. While these activities are essential to maintaining the reliability of high-risk organizations, the fact that they are subcontracted is frequently blamed for industrial disasters. In the short term, this leads to financial gains, but also to adverse effects, especially in terms of skills. An in-depth, longitudinal, and multi-level case study within the high-risk business line of a major government-owned company enables us to map out the skills-loss process, to identify the factors behind it, and to inform the analysis of the relationship between inter-organizational control mechanisms and the skills that are required to perform the outsourced activities.

**Of chips and men: When working in Industry 4.0 is more human than expected**

**Véronique Blanc-Brude & Christian Defélix.**

In order to address the challenges of efficiency and manufacturing quality, the high levels of automation and data integration that characterize Industry 4.0 make it possible to produce customized runs at a similar cost to mass production, which leads to the creation of vibrant and complex work situations. In “flow” industries, such as microelectronics, very real human work becomes

less visible as it only occurs in the event of a flow or process interruption. But what exactly are the consequences of this automation, pushed to its maximum, on the work and the skills required for production operators? This paper is based on an industrial case study, where the search for high performance levels and the increase in automation lead to increased monitoring of anomalies. The theoretical framework chosen is that of invisible work and its threefold experience (Gomez, 2013), which allows us to discover a change in work that is not really considered by the official organization. Thanks to a qualitative approach combining direct observation and semi-structured interviews, this research reveals that the work experience is marked by a ballooning objective dimension, a far cry from the most frequent, flattering presentations of Industry 4.0. A collective, non-official component is still necessary, with many interactions. Lastly, the subjective experience reveals many areas of tension. Thus, “4.0” work, even if it is more automated, turns out to be much more human than expected.

## OTHER TIMES, OTHER PLACES

**Is Kodak’s collapse a closed case?**

**Albéric Tellier.**

Kodak’s bankruptcy is generally considered to be an exemplary case of disruption. Our objective is to revisit this assertion, which has circulated widely among researchers and the general public.

A systematic analysis of company data published between September 2003 and January 2008 demonstrates that disruption theory does not fully explain Kodak’s decline. In particular, our analysis highlights the role played by shareholders in rejecting the company’s initial digital strategy.

Our findings demonstrate the impact of shareholder activism on disruptive innovation strategies. They also allow us to discuss the risk of circularity bias in using case studies to illustrate theoretical approaches.

## MOSAICS

**Antoine Masingue**

“On Luc Ferry’s *La frénésie du bonheur*” (FR: Éditions de l’Observatoire) 2023.

**Guy Maugis**

“On Walter Isaacson’s *Elon Musk*” (US: Simon & Schuster) 2023.

**Hervé Dumez**

“On Alain Prochiantz’ *Accident. Regard sur la république des sciences*” (FR: Odile Jacob) 2024.



## Ont contribué à ce numéro

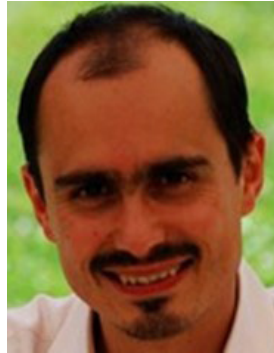


D.R.

Après avoir soutenu une thèse à l'IAE de Paris (Université Paris 1 Sorbonne), **Salomon BERNIER-KHEDACHE** est désormais maître de conférences à l'IAE Gustave Eiffel (Université du même nom à Marne-la-Vallée et laboratoire IRG). Ses recherches portent sur le rôle de l'instrumentation de gestion dans des contextes de mutation (notamment le cas des réductions d'effectif) et dans le secteur de l'Économie sociale et solidaire. Ses travaux ont eu une visée majoritairement compréhensive et s'appuient plutôt sur des démarches qualitatives. En termes d'enseignement, il intervient principalement en pilotage de la performance, contrôle de gestion et méthodologie de mémoire. Il est également responsable de la licence 3 CCA de l'IAE.

Doctorante à Grenoble INP-Université Grenoble Alpes, **Véronique BLANC-BRUDE** a eu une première partie de carrière de vingt ans en entreprise comme directeur RH et d'unités commerciales, en France et en Suisse. Sa dernière expérience au sein d'une société indienne spécialisée dans la digitalisation de la chaîne d'approvisionnement la conduira à vouloir mieux saisir le concept d'industrie 4.0, en démarrant une thèse. Son travail de recherche porte sur l'impact de l'automatisation 4.0 sur le métier de technicien opérateur de production, et ses dimensions en tension, dans le secteur de la micro-électronique.

Professeur en gestion des ressources humaines à Grenoble INP-Université Grenoble Alpes, **Christian DEFÉLIX** a travaillé sur les systèmes de gestion des compétences et l'évolution de la fonction ressources humaines. Il co-anime au sein de Grenoble IAE la chaire « Capital humain et innovation », avec les partenaires de haute technologie de l'écosystème isérois. Ses dernières publications portent sur la gestion territoriale des ressources humaines et l'innovation managériale.



D.R.

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