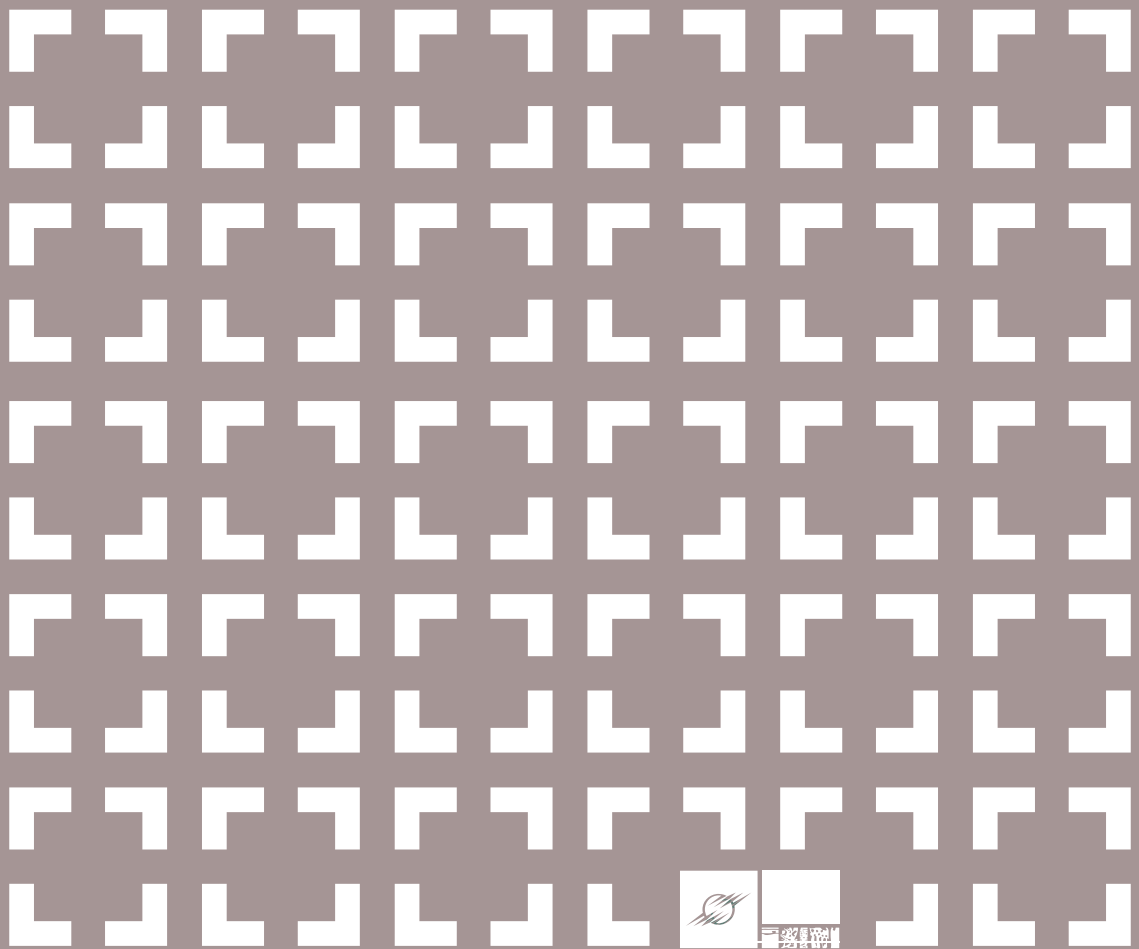


WHITE PAPER

COMPANIES OF THE FUTURE

THE ISSUES OF DIGITAL TRANSFORMATION



INSTITUT
Mines-Télécom

COMPANIES OF THE FUTURE

THE ISSUES OF DIGITAL TRANSFORMATION

White Paper

Edited by Madeleine Besson

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FOREWORD

Christian Roux, Executive Vice President for Research and Innovation

Digital innovation is bringing a great deal of change to industry, the economy and society. Radical transformations are being seen in the way these fields are organized, in their products and uses.

Institut Mines-Télécom has always had a very close and privileged relationship with the economic and industrial world. IMT plays a major role in research partnerships and innovation, and support for economic development. The Industry of the Future is a strategic priority for IMT in facing future challenges and accompanying companies in their transitions.

As a founding member of the Alliance for the Industry of the Future, IMT's unique position at the crossroads between industry and the digital world allows it to comprehend ruptures involving both the changes to processes and industrial management modes, and the digital tools involved. Although it is well known that a great deal of the potential effectiveness of digital technology lies in this joint transformation of our working methods and tools, the impact of this technology on the transformation of companies remains an active field of research. With vision and action based on the Training-Research-Innovation continuum, IMT is involved on all three levels of this major transition.

As well as confronting the great challenges of more effective, safe, economical and flexible technologies, the Institute is extensively involved in this transition, imagining new organization models for companies, new products and services, new economic models, without forgetting the changing place of humans in industrial and organizational processes, along with new jobs and skills.

This white paper, written under the supervision of Madeleine Besson, presents the current concern over the challenges of digital transformation for the company of the future. What will be the changes to companies' processes and business models? How will the notion of value creation change? What impact will this transformation have on the role of humans in companies? These questions, along with other equally pertinent ones, are studied by experts at IMT, questioning the very notion of the company and the meaning of its traditional links (design, production, use, the customer, value...).

To understand the impacts and formalize the challenges of research for the company of the future in a relevant way, we must have a solid grasp of digital transformation.

Technical, economic, human and societal responsibility aspects must be analyzed in order to find the integrated, transversal approach, which is essential to relevant and effective reflection over this complex, multi-faceted matter.

These reflections must also take an historical approach. In this respect, the "ecosystemic" analysis proposed by Thierry Isckia sheds light on the changes that digital technology has imposed, at the same time noting the importance of the strategic dimension.

Regarding future changes, Godefroy Dang Nguyen suggests some transformational leads that the digital world offers, in particular the new forms of cooperation providing a source of significant change to the institutional framework. The question of entrepreneurship in 2050, asked by Daniel Kaplan, provides the opportunity to open the field of study to include the changes in the structuring element of a company in the face of ecological and environmental transition, as well as transgenerational transition. Climate change and the ageing population are challenging the traditional determiners of progress and well-being.

Finally, this white paper questions the very idea of the company itself, and the meaning of all of the traditional links in value creation. It provides the curious reader with several entry points to understanding the challenges of digital transformation for the future company, and certain key areas for reflection on this matter, which keeps gaining in speed and intensity.

THE ISSUES OF DIGITAL TRANSFORMATION

E. Baudoin, S. Berger-Douce, M. Besson, I. Boughzala, P.-A. Chardel, G. Dang Nguyen, M. Feki, V. Fernandez, R. Gola, C. Gossart, E. Henriette, T. Isckia, B. Léger, N. Jullien.

Digital transformation, also referred to as **digitalization**, is a protean concept that is viewed differently by academics and professionals. Some academics define it as *“the changes that the digital technology causes or influences in all aspects of human life”* (Stolterman & Fors, 2004, p. 689). Professionals, in more provocative terms, believe that *“digital transformation is the radical development of the possibilities of the Internet”* (Ludovic Cinquin, CEO of Octo France, a company specialized in supporting companies in their digital transformation). This definition is similar to another that presents **digital transformation** as *“the use of technology to radically improve performance or reach of enterprises”* (Westerman *et al*, 2011). In these last two cases, the assertions emphasize the drastic nature of the transformation that is underway and present its three radical aspects in the following areas:

- the change in the time dimension (the Internet removes time barriers);
- the change in the spatial dimension (the unprecedented ubiquity provided by mobile technologies);
- access to the masses (the Internet removes audience restrictions).

Companies are driven to rethink their processes and the way they interact with stakeholders due to pressure from new entrants,

the need to adapt to new consumer behaviors, or the goal of making the most of technological tools in the areas of innovation and productivity.

The speed and magnitude of this ongoing transformation, driven by the most recent wave of ICT, has caused certain authors to begin using the term **“acceluption”** (Bounfour, 2016). This neologism highlights both the massive **expansion** in value creation by companies, and the digital **acceleration** that leads to instantaneous exchanges within society and the within the company. We believe these two aspects accurately represent the digital transformation that is underway.

The novelty trap

The idea of digital transformation raises questions about the nature of the developments that are now possible following the most recent advances in the area of ICT. The various waves of technological development have all, to varying degrees, had deep impacts on developments on a socio-economic level and for organizations. This historic dimension must be kept in mind to avoid falling into the trap of the novelty effect. Digital transformation is not a new phenomenon: the expression first appeared in 2000 (Patel & McCarthy, 2000), and at the end of this study, several pages have been dedicated to a literature review on the subject (see below: Focus *“Digital transformation: a historical perspective”*).

Profession-specific or macro processes are no longer the only areas affected by ICT developments (Hammer & Champy, 1993), and all business processes, support processes and even the very design of the organization are now impacted. Because these processes are all aimed at creating value, the business model will naturally and progressively become the focus of much attention (business model

innovation), as will relations with others (relational turn) and relational strategies. Companies are driven to rethink their processes and the way they interact with stakeholders due to pressure from new entrants, the need to adapt to new consumer behaviors, or the goal of making the most of technological tools in the areas of innovation and productivity.

Digital transformations redesigns the role of humans in companies. All automatable tasks are in the process of becoming automated.

All actors agree that digital transformation shifts value creation within sectors, whether it be the industrial or service sectors, for companies working with industrial customers or with the general public. The concept of the business model, which struggled to find its place in the academic world in the late 1990s, has become one of the most widely studied concepts in management literature. At the same time, digital transformation redesigns the role of humans in companies. All automatable tasks are in the process of becoming automated, from the robotization of the operations of automobile production lines to the automation of the tasks carried out by office employees and cashiers. Robotization also enables build-to-order production and the possibilities of customizing products and services. *“Added value is progressively moving from the completion of the tasks themselves towards three different areas: the way customer requests are made, the design of the solution and the automated equipment that meet the requests and, finally, the service, which involves delivering to the customer.”* (Landier, 2014).

New opportunities, increased requirements

From an economic standpoint, the anticipated earnings resulting from the digital transformation have been assessed by McKinsey, which predicted an increase of 3.6% of the GDP by 2020, (7% in 2015), with a €15 billion market (€23 billion respectively) for equipment involved in these prospects (McKinsey, 2013). French companies seem to be lagging behind to some extent: according to Roland Berger (2014), while 57% of French companies identified digital technolo-

gies as a strategic medium-term issue, only 36% had a plan to prepare for the changes. It is a fact: the revolution of digital uses begins with the general public and progresses more slowly in the business world. Whereas 54% of French people make purchases on the Internet, only 11% of French companies utilize this sales channel.

Conversely, in France, as is the case in several countries, today's most connected customers are also increasingly demanding. They expect companies to adapt quickly and provide customized solutions to their changing consumer needs – particularly the new digital generations – causing companies to adapt their marketing practices (Pardo & Etay, 2014). To respond to new consumer behaviors, companies have had to revise the way they track new consumer trends (which includes considering local producers, the makers), design their services prior to production (co-creation) and deliver the services, in order to communicate with users and consumers that are part of the networks and communities. This transformation takes place, among other means, via the use of CRM (Customer Relationship Management) tools, which integrate a strong social aspect by using social network analysis modules and also creating a connection between data from within the company and external data on customers, according to Davenport *et al.* (2012).

In industry, some companies are leading the way in integrating information technologies, by exploring the possibilities for innovation that are opening up for their customers and staff, and optimizing their production lines by integrating an increasing number of sensors to handle incidents locally. Industrial companies, which are not well known for being connected with digital technology, such as Air Liquide and Michelin, have proven how important this development has become for their management.

The three components of the digital transformation

In France, following approximately fifteen debates and co-construction sessions, plus consultations with over 500 stakeholders, the Lemoine Report articulates a vision of the dynamics at work in the digital era and concludes that “*digital transformation is the opportunity that France must seize*” (Lemoine, 2014). In this report, digital transformation is described as a combination of **automation**, **dematerialization**, and the **reorganization** of intermediation models. These three groups of effects interact with each other, and are strengthened through this interaction.

- **Automation.** This group is based on the effects of increased performance resulting from the use of production factors: work productivity, capital productivity, the productivity of energy and raw materials, but also the increase in the capacity of individualizing supply (build to order production, with 3D printing movement as its paragon).
- **Dematerialization.** This leads to the appearance of new communication and distribution channels that replace or transform the physical networks of agencies, offices and stores, while at the same time decreasing marginal production costs and transaction costs.
- The third group, **disintermediation / reintermediation**, involves the effects of reorganizing value chains. The sudden appearance of new actors positioned in between companies and their customers requires business and intermediation models to be reinvented, particularly in terms of the new role that people play and the new assets derived from the data.

The following part of this study is made up of three sections that will successively present the following aspects:

- the levers of digital transformation; (p.12)
- its impacts; (p.14)
- and, finally, some of the research focused on economic, human and social responsibility issues for companies of the future. (p.16)

THE LEVERS OF DIGITAL TRANSFORMATION BY 2020 / 2025



The radical nature of the digital transformation mentioned above is based on two new levers that have already been extensively documented: first, big data and the Internet of Things, and secondly, an emerging phenomenon with impacts that are currently lesser known, which is individuals and communities being in charge of the production of certain goods (DIY, and collaborative production). These levers reinforce the digital transformation that has been initiated by digital communication tools (Internet, mobile communication, Cloud Computing), which continue to fuel the digital transformation of companies.

Big Data

The rapidly expanding sources of **big data** include tracking website activity, social media content (blogs, tweets, Facebook, etc.) and video data. Every day, Google alone processes approximately 24,000 terabytes of data. Yet **big data** also encompasses all the data from call centers, genomic data, as well as data from biological research and the medical field. In industry, the increased use of sensors provides companies with big data on the status of machines and industrial processes, authorizes incidents to be treated locally and, by making use of big data methods to analyze past data, significantly increases the possibility of preventing these incidents. In the same way, *in silico* prototyping relies on virtual reality and big data to provide industrial engineering consultant firms with particularly flexible and inexpen-

sive tools for optimizing the design of machines and tools. Yet difficulties still remain for companies, since only a small portion of the information is formatted in the rows and columns that form the basis for traditional data.

A key principle of big data is that the world and the data that describes it are constantly changing. In this new context, the key success factor for organizations is the ability to recognize the changes and respond to them quickly and intelligently. While stability and

scale were the most critical criteria for 20th century companies, the new advantages are based on discovery and agility; within this environment, performance is led by the ability to make continuous use of existing and new sources of data, enabling new models and opportunities to be identified. (Davenport *et al.*, 2012).

As the architecture of big data progresses, it will develop within an information ecosystem: a network of internal and external services that are constantly sharing information, optimizing decisions, communicating results, and creating new perspectives for companies (Davenport *et al.*, 2012).

The Internet of Things

What will the features of the **Internet of Things** (IoT) be, and what will its impact be (Fleisch, 2013)? The Internet of Things can influence industrial production methods related to the mass use of sensors as was previously mentioned, and also ways of life:

- ❑ through environmental monitoring and by automatically securing objects;
- ❑ through the automation of close contacts, with machine to machine interaction, and also with human to machine interaction;
- ❑ using feedback, from the object to the human and the contribution of additional data (augmented reality).

It enables manual tasks to become automated, handles complex problems (in conjunction with big data) and makes it possible to innovate based on these new measurements and processing methods.

Collaborative production

Almost thirty years after the lead user method was brought to light at MIT (Urban & Von Hippel, 1988), collaborative production, expanded to include a group of users that

cooperates to define their needs, is gaining new ground. After free software, and open hardware, today there are open car production plans, the development of Fab labs and 3D printing is also underway. This development, which has also been marked by the appearance of urban third places dedicated to creativity, has impacted industrial production. A reorganization is being considered, at least in certain sectors, based around the concept of standard large component production factories, and local factories for assembling the components closer to the users, with high automation rates. A renewal of artisan production can also be imagined, as well as custom development, similar to the recent developments related to short supply chains, particularly in the area of the food industry. In any case, the relationships between producers and users will need to change drastically in the coming years and a new world seems to be opening up for industrials, both in terms of working with customers/consumers in designing the products and associated services and in getting company staff involved in internal competitions that could lead to creating start-ups, as in the case of Michelin.

The relationships between producers and users will need to change drastically in the coming years and a new world seems to be opening for industrials.

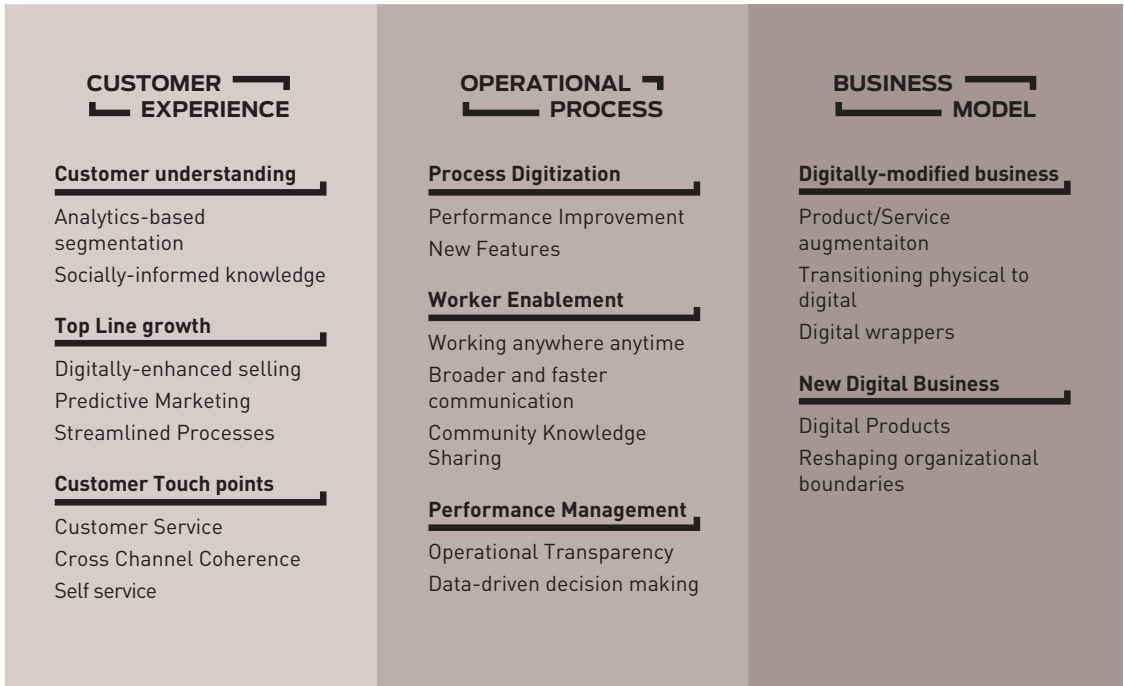
Another change caused by the interaction of industry with “the masses” involves recycling and waste management, its reuse, and what could be called **delayed obsolescence**. The circular economy is a strong trend in the industry, particularly for consumer goods.

These developments are combined in the phenomenon of **servicizing** the industry. Since the end of the 20th century, the standardization of many products and the growing competition with emerging economies have driven industries in developing countries to respond to their customers’ needs by creating solutions that integrated products and the associated services.

THE IMPACTS OF THE DIGITAL TRANSFORMATION



The impacts of the digital transformation are beginning to emerge on three different levels: the transformation of customer relations, the transformation of operational processes and the change in business models (Westerman *et al.*, 2011).



Westerman et al., 2011

The **customer experience** is fueled by information that is increasing in size and variety, through digital social media that an increasing number of individuals have joined, and soon through connected object networks. Organizations seeking to provide satisfaction in the area of customer relations must think about the consistency of communication, and integrate new methods for monitoring markets, including the analysis of big data from the internet, which requires the development of new infrastructures and skills.

Big data must also allow organizations to better manage their **operational processes** (the robotization of production tasks, among others), to individualize their product and service offering (geolocation, authentication, auto-maintenance, interactive human services, etc.), and to give staff greater autonomy to respond quickly to new information.

Organizations seeking to provide satisfaction in the area of customer relations must think about the consistency of communication and integrate new methods for monitoring markets.

Yet beyond the customer experience and the processing of big data, there is the interaction with the multitudes, as was previously mentioned, which represents a new aspect introduced by digitalization, since it has never been easier to interact with anyone, no matter where the person is, under any conditions.

Finally, the **very definition of the value created by the company** must be reconsidered, whether this involves designing new services using digital technology or revising the boundaries of the firm.

RESEARCH ISSUES FOR COMPANIES OF THE FUTURE



There are a great number of scientific challenges involved in this context of the acceleration of digital transformation, which not only alters operational processes, but also allows the customer's position to be redefined and, in the end, redefines the value created by companies. While the technological challenges are well taken into consideration in France, research challenges in the areas of the economy, management and social sciences must not be underestimated. The following is a presentation of what we consider to be the major issues, which are the focus of in-depth studies currently being carried out by research teams at Institut Mines-Télécom schools.

Technical issues

Digital technologies contribute to the transformation of the organization and the operating methods within companies through the automation of processes and the changes in project and professional practices. The key success factors in the new digital environment seem to be the ability to align the technologies and their uses with the company's strategies, to master the sources of internal and external data, to identify the algorithms that provide meaning to the collected information, and have access to the skills required for a coordinated work within the organization. An issue that has become more important than ever before is the concept of governance in the area of information technology that would enable IT organization and would support and develop the organization's strategy and objectives. The goal is for digital technologies to improve the value creation processes, while still taking into account risk management and performance techniques [Bounfour & Fernandez, 2015].

At the same time, specific questions have been raised:

- ❑ What are the specific new uses of digital technologies in companies that integrate big data or machine learning?
- ❑ What impact do these technologies have on production organization?
- ❑ How do digital technologies influence service offerings such as MaaS (Mobility as a Service)?
- ❑ How are interactions developing between decision makers for information systems and those for business in connection with

digital transformation, and what type of governance should be established for digital technologies?

- ❑ How should the urbanization of digital transformation be handled and how can the security of information systems be guaranteed as digital transformations progress?
- ❑ How should interactions with the multitudes be handled?

Economic issues

Digital technologies continue to promote new methods of organization and new intermediations, profoundly transforming the economic models inherited from the industrial revolution, and the place of the consumer/user. At the same time, the way organizations collect and process big data, while continuing to reassure participants concerning the processing methods, could represent an intangible asset of prime importance, that is not yet sufficiently valued by markets.

In the same way that financiers now integrate the concept of brand equity into the valuation of firms, we believe that, in a knowledge-based economy, companies should be able to define and enhance their **digital assets**. A major issue would then be to check if a company has digital assets and, if need be, evaluate these assets.

In a knowledge-based economy, companies should be able to define and enhance their digital assets.

Whereas the media industry was very affected early on by the digital transformation of cultural goods, in which consumers themselves chose to become music and film publishers (Poels, 2015) by using platforms for electronic exchanges, other industries are only at the beginning of major transformations, such as the health and automobile industries. Many companies are still affected by the following questions:

- ❑ How is the organization developing and how can the digital tools contribute to this development?
- ❑ What impact does the digital transformation have on the industry's structure and the nature of competition?
- ❑ How does the digital transformation transform a company's value chain and business models?
- ❑ How does the digital transformation impact ecosystems and how they are restructured?
- ❑ Are new activities emerging in a new context of value creation?

Can this value be shared within the meaning of Porter and Kramer (2011)?

- ❑ What are the new skills and systems required for attracting attention and creating loyalty in relation to the Internet of Things and big data?
- ❑ In an environment that is characterized by open innovation, in which a collective intelligence can be mobilized within and beyond the boundaries of the company, how can the design process be reinvented (cycle from design to recycling, co-production, etc.)?

Human issues

In both factories and companies of the future, human activities will be increasingly dependent on digital mechanisms. Human issues must therefore be reconsidered within this context. They could be the key to release the whole potential of digital possibilities.

➤ How will digital technologies be implemented and appropriated by all the relevant stakeholders?

One of the essential conditions for a return on investment in the use of digital technology in the workplace is that of its appropriation (De Vaujany, 2005; Grimand, 2012) by organization staff, managers, and executives. The identification of digital technology appropriation factors in a given context is therefore essential in order to work on the implementation strategies for all of an organization's stakeholders. The fact that digitalised processes work from a technical standpoint is

one thing. The fact that they are totally and properly appropriated by employees, managers and executives, is another thing. Many projects fail because the participants don't want to jump in, are afraid of using a new system, have not the skills or/and don't have the support of their managers, just to quote a few.

Making use of digital technology impacts both individual and collective skills in all organizations. According to two studies conducted by the HRM DIGITAL LAB of Telecom Ecole de Management, five skills are already essential in a digital world : technical, informational, relational, metacognitive skills and creativity (TIRMC). Technical skills are the abilities to use the different functions of a software and/or a device. Informational skills are the abilities to find and analyze the pertinence and use of digital information within a given context. Relational skills cover the abilities to interact with a person or a group through digital systems in an appropriate way. Metacognitive skills are related to the capacity of analyzing its own behavior, strength and weakness, and being able to adapt its behavior in a digital context. Creativity is the ability to use the potential of digital to think in a different way and imagine new solutions.

In both factories and companies of the future, human activities will be increasingly dependent on digital mechanisms.

► How to transmit and develop skills?

The necessity of transmitting and developing skills is impacted by a combination of three factors: retirement which creates the need for senior employees to transmit their skills to younger colleagues, the increasing use of digital technology, and the need to innovate in order to remain competitive.

The use of different types of approaches raises many questions:

- ❑ How will the industry of the future attract the skills it will need when it has to compete with other sectors which are sometimes more attractive, and simultaneously, the qualified human resources are sometimes scarce ?
- ❑ How to take into account that employees, whatever their generation, are nowadays learning in a different fashion as they used to in the past ? It's more and more common that some employees learn by themselves thanks to digital devices and services like

MOOC, videos on youtube, aps on their mobile phone etc. Some companies have started to take into consideration this new phenomenon. For example, certifications earned through MOOCs are recognized in certain organizations, but rejected in others.

- ❑ How effective are the different systems of formal training and informal learning in companies ? What are the conditions of the effectiveness of these different systems?
- ❑ What interactions exist between these systems? How can companies make them work in a complementary way?

► Analysis of job trends

Skills and jobs are two factors at the heart of an organizations **human resource planning** (HRP) policies. In France, three-year HRP agreements are mandatory for companies with over 300 employees.

In the context of digital transformation, while many studies predict the theoretical probability of a robot replacing an office employee, a credit analyst, or a laboratory technician to be 0.99, 0.98 and 0.97 respectively, it becomes essential to better understand the coming trends. The objective is to try to meet the needs of industrial companies to recognize societal issues regarding the employability of staff members.

- ❑ What are the different jobs of the future in the area of industry, and in general terms, for the company of the future (Berger-Douce, 2015)?
- ❑ How can the tasks that staff carry out on production lines be redefined to become "smarter"? How to help employees to upgrade their skills ?
- ❑ How can the overall French educational system prepare to train students in these future skills?

More specifically, digital transformation seems to generate new positions, such as Chief Data Officer or Data Scientists. All of

these new positions contribute to better identifying and defining, especially since initial reports reveal that some of the skills required for these new professions belong to a different category than their predecessors; thus the skills expected of a Chief Data Officer are less connected to IT expertise than to a subtle understanding of the digital behavior of stakeholders, and the ability to facilitate the necessary change within the companies, in order to meet their needs in an appropriate manner.

Furthermore, for over a decade at least, different studies have shown a constant progression from salaried positions towards self-employed work, and the outlook shows a progression towards organizations based on core business, coordinating with independent service providers (for example Gratton, 2011).

Issues of social responsibility

Issues of social responsibility in the companies of the future are closely tied to the digital transformation of organizations. We cannot ignore the voices that warn of the structural risks linked to this transformation, whether it be in the area of job destruction (Brynjolfsson & McAfee, 2012), or the transformation of the web, becoming a “*machine creating entropy*” (Stiegler, 2015).

After analyzing the technical impacts of the digital transformation, it is necessary to highlight a few human issues (in terms of a companies’ customers and staff) as well as ecological issues.

► Legal issues surrounding the use of big data in the companies of the future

Establishing a climate of trust in the online environment is essential in the economic development of the companies of the future, and it can be established by protecting citizens’ personal data. Without this trust,

players will hesitate to commit, which will eventually slow down innovation in the uses of information technology and communication. The issue of personal data is a recurring one, and creates much debate with the development of big data and the Internet of Things.

Establishing a climate of trust in the online environment is essential in the economic development of the companies of the future.

The matter has been taken up by the European Union, which has begun the process of reforming the European legal framework for data protection. The previous European directive on the issue dates back to 1995 and no longer meets the needs of the current developments. The role of the Internet in individuals’ everyday lives is now omnipresent, and the use of social media enables the exponential increase of the personal data being shared. Furthermore, this data, which some see as the black gold of the 21st century, has become essential for the digital economy, and the use of increasingly connected objects greatly contributes to the increase in data. The analysis and connections of the data produced by these objects will therefore open up countless horizons for companies to explore, whether it be industrialists who produce the items, or operators offering services supported by these connected objects.

On January 25, 2012 the European Commission unveiled a proposal for a regulation on personal data protection, which overhauls the entire European legal framework originating from the 1995 directive and will be applicable in all countries of the European Union in 2018.

The regulation establishes a new balance of rights, obligations and sanctions based mainly on the concepts of accountability and privacy by design. It creates a paradigm shift in the regulation of personal data, not as much in the principles themselves (purpose, loyalty, security...) but in the regulation tools available for stakeholders and regulators. The desired governance model results from a social contract established between the public and private stakeholders, which is necessary for the development and application of the rules that ensure compliance with the European regulations. While the regulation necessarily involves new constraints for companies, it also offers an opportunity for companies to become more transparent in their data protection policy. The company’s compliance with the legislation can only be of benefit, enabling it to maintain a good online reputation in the framework of responsible innovation; it will, however,

require industrialists to have a good understanding of the new legislative arrangements.

► Ethics and the right to opacity

It seems contradictory to seek to establish a managerial dynamic that is at all concerned with personal development of individuals without formulating a principle of responsibility, founded on a right to opacity. This is of course necessary, even if the company is a place that by definition features a concept of subordination: *“The relationship between an employee and an employer is not a parent/child relationship, nor is it a connection of equality as citizens, but, rather, an agreement made in the framework of a defined activity, that is work, within a community providing goods and services”* (Legoff, 2000). The employee is therefore naturally subject to being monitored by the employer in the context of the work he or she performs. That being said, the recent changes in work doubtless require a greater respect for autonomy to be taken into account. In the era of cognitive capitalism, in which the worker must make greater use of their intellectual capacities, the quality of the work conditions become all the more critical. This means that while current technologies enable every instant to be maintained under surveillance, the current work demands and contemporary features require that employees be granted a maximum level of freedom, because in this way they will be at their most creative and most efficient (Chardel, 2014).

► Tracking, privacy and putting the consumer to work

The digitalization of the economy is reflected in a notion of traceability, which provides the real-time measurement of customers' use of a product. This information is used for order confirmation (Build to Order or BTO model) and could also be used to optimize production and inventory. This results in a measurement of each individual's uses and practices that is more and more precise.

The analysis of the tracks that are left both voluntarily and involuntarily on social media or on the websites of organizations already leads to much analysis and commercial targeting, and the issue of privacy is already being studied in this context. For connected objects, the study of tracks would be combined with an analysis of the data use collected by the connected objects.

Furthermore, the item that is ordered online, received at home (possibly even produced at home or in local production centers, using standard components produced in large production centers) for which the instructions can be found on a website or an application that includes the customer's "intellectual participation" (Eiglier and Langgaard, 1987), which would play an increasingly significant role.

- ❑ Under what conditions will the customer accept to be increasingly put to "work" (Dujarier, 2014) by companies?
- ❑ How can the necessary trust be maintained between the brand and

consumers in a connected world, in which even the use of the object is a potential source of information for the manufacturer?

- ❑ Is it possible to define a Privacy by Design policy?
- ❑ How does someone go from being a consumer to being a contributor?

► Interest and meaning to the work of staff in companies of the future

Promoting management with a human touch requires the significant appropriation of communication and information technologies, which involves managing dematerialization as both a technological and existential challenge within the same company. The digitalization of certain tasks will also often call into question the interest and the meaning of work carried out by staff members (Berger-Douce, 2015). Yet the quest for meaning is at the heart of staff members' concerns, particularly for younger staff. Moreover, this implies revising what leadership means, with leaders of tomorrow who are fully aware that their power is no longer found in having information, but in their agility to use it.

- ❑ How can these changes and transformations be characterized?
- ❑ How can their consequences for staff be anticipated and reduced?
- ❑ What are the values involved in a dematerialized company?

Leaders of tomorrow will be fully aware that their power is no longer found in having information, but in their agility to use it.

› The digital company faced with the challenge of complexity

The technological reality in the world of organizations is like a cold, hard fact for which it is very difficult, from an ethical point of view, to ignore the consequences for individuals. Technological mediation falls fairly spontaneously into an approach that promotes interactivity. In the company that is in a network, the exchanges of information have become more fluid and immediate. Beyond the obvious repercussions of such a system on management, the logics of efficiency and productivity are directly affected. In this sense, the use of ICT reveals an instrumental rationality aimed at integrating an organization within competitive environments that are increasingly complex.

However, the desire to manage an organization in the best way possible from a technological perspective does nothing to address the issue of the collective action. Such an ambition also does not address the human aspect and its complexity. It is not enough to accelerate communication in order to promote exchanges and mutual comprehension. The quest for strong communicational transparency represents a factor that accentuates significant contradictions from an ethical point of view. While relations with others can become more fluid based on the reasoning of immediacy and hyperconnectivity, they can also create very paradoxical forms of communication breakdowns within the organizations themselves, which is an issue that must be studied in greater depth.

› Digital companies and eco-innovation

Among the issues facing tomorrow's digital companies, environmental issues represent both constraints and opportunities. The environmental constraints are connected to the negative environmental impacts of digital technologies throughout their entire life cycle, and their **rebound effects** (Gossart,

2015). It is indeed necessary to raise questions about the potential local and global impacts caused by these new operating modes, in which digital technologies play an important role, and the dependency on the resource, for example in the area of the gains obtained through monitoring.

To limit these effects, the digital company of the future will need to generalize the eco-design of its products and services, without creating rebound effects, in other words, eco-design all of the equipment and software it produces, without diminishing the prices, and mastering the application and uses of equipment in order to limit errors that would cancel out the expected gains. In terms of opportunities, the digital products and services will be used to significantly reduce the negative environmental impacts of other sectors by monitoring natural ecosystems, using smart grids, and raising awareness on ecological issues (Garello and Gossart, 2015). The digital company of the future therefore has everything to gain from fully participating in the ecological transition.

CONCLUSION PERSPECTIVES

Godefroy Dang Ngyuen



Information Technology has existed in large companies for more than fifty years, and we might wonder why this insistence on digital

technology is so strong today. In our changing business world, accessibility to the Internet and mobile phones can embody passing trends and distorted views, but more importantly, this digital transformation may seem surprising: in fifty years, haven't companies managed to grasp what digital technology is?

In reality, what is new is the widespread connectivity between all people, so obvious that it does not require further explanation, but in particular, the widespread accessibility to information through the trio of the Internet of Things, big data and platforms. Another development is that the company, as an institutional object, is potentially under threat. Incidentally, companies sense this threat and the majority fear being "uberized". Indeed, the massive influx of information and the rapid availability of resources thanks to platforms, provide a special context where we observe two phenomena:

- There have never been so many opportunities to "do business". The increase in the information available to individuals is a permanent and strong invitation to become an entrepreneur, not only in the narrow sense of creating a startup, but also in terms of coordinating a group action, a source of value creation. The entrepreneur's double-identity, both seizing opportunities, in the tradition of the Austrian economists (Mises, Böhm-Bawerk and even Schumpeter), and also coordinating group action, according to the institutionalist authors (Marshall, Alchian et Demsetz, Williamson) is gaining in importance. The entrepreneur is not necessarily motivated by financial gain (nor would this be sufficient).

- The entrepreneur's task of coordinating activities has become even easier thanks to easy-to-use technical tools (platforms), accelerating the obsolescence of complex organizations, built on the precise coordination between people. This tool frees itself from the constraints of time and space, and is so easy and quick to implement, that the institutional structures it was intended for have not had the time to adapt. This is how Uber caught taxi drivers off-guard, and how AirBnB did the same with hotel chains. All business sectors, and even (especially?) the most highly controlled, face, or will come to face this challenge.

The company, as asserted with the Industrial Revolution, and as imposed during the 20th century, is not only the fruit of the talents of

great industry commanders, of which Alfred Chandler (1962,1977) demonstrated the organizational benefits over the last two centuries, but it now also results from an adaptation of the institutional environment, particularly that of the State. Freedom of contract was established at the foundation, guaranteed by public power, along with property rights, both individual and collective (private stock company, cooperatives), commercial law structuring freedom of contract, social law guaranteeing collective action in a context of subordination. Added to this, is the right to competition, intellectual property rights, etc., all of these institutional constructions define the relationships between the economic players in a well-defined context. But human creativity has brought about a large number of intermediary structures between the company and the market: subsidiaries, franchises, partnerships, joint ventures, long-term deals, in order to organize cooperation in the most flexible way, and the best-suited to the context. Overall, the institutional framework has not been brought into question before now.

As Seabright (2010) demonstrated, this entire institutional architecture has but one goal: to ensure that people cooperate in an effective manner. Although the principle of competition (combined with freedom of contract to form what we call “the market”) is nothing more than a way of encouraging people to cooperate, in this instance sellers with buyers: the former cooperates to deliver the product, the latter to settle their debt.

Yet, digital technology has the ability to undermine this institution, because in giving the possibility to gather a lot of information, it opens the way to entrepreneurship on an unprecedented scale: simply speaking, and to use J. Schumpeter’s terminology, the power of creative destruction will be multiplied in the future, compared with what it is now. What is more, in providing the technical tools to make these entrepreneurial initiatives happen faster (the few that do succeed), digital technology raises a certain obsolescence

of the institutional framework guaranteeing the longevity of roles and statuses, a framework from which people negotiate forms of cooperation amongst themselves.

But the abundance of information on people and the network effects potentially giving rise to a greater amount of mimetic behavior are, on the other hand, levers leading to “systemic” dangers spreading quickly from one zone or sector to another. For example, the logic of economic figures with the strongest market powers can sometimes interfere with fundamental State missions (see the FBI/Apple disagreement about cracking encryption software), without the State having the necessary tools to outweigh the economic power. In another respect, the deep web is both a space that protects privacy and an ideal place for all conspiracies.

What is at stake here with digital transformation, is the implementation of a system of value creation that is much more heterogeneous than ever before.

Thus, what is at stake here with digital transformation, is the implementation of a system of value creation (last century we would have called it a productive system) that is much more heterogeneous than ever before. Different forms of organizing cooperation will have to coexist: companies, all types of partnerships, groups, platforms. The institutional framework will therefore have to adapt to this variety. Agility, company spirit, or simple initiative will be key to the success or longevity of economic figures. But institutional reactivity, the ability to adapt or even anticipate these players’ logics and redirect them towards the “public good”, will be just as important. This document is an invitation by researchers at Mines-Télécom to tackle these questions.

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DIGITAL TRANSFORMATION: A HISTORICAL PERSPECTIVE

Thierry Isckia

What has been developed thus far in this report has shed light on the transformations that are now possible through the spread of electronic communication technologies. Yet these new possibilities must be kept in their historical context. The past decades have brought a succession of waves of technological development that have all, to varying degrees, impacted socio-economic development and the way companies operate.

The decade of the 1990s, for example, was characterized by considerable advancement in means of communication made available to companies. The development of the Internet for the general public brought fresh momentum to the area of information technology, which resulted in significant changes to network infrastructures and, as a consequence, the emergence of new application solutions such as groupware (groupware tools are part of support systems for collaborative work, called Computer Supported Cooperative Work, CSCW), which contributed to a change in companies' work methods and even their organization. It was primarily during this decade that the **company-network** was formed, a symbol of work spaces that were geographically scattered, business relations that were denser and greater in number, work that was more collective, within organizational structures that had become more flexible, and employees who had be-

come more mobile (Buttera, 1991; Nohria and Eccles, 1992; Hastings, 1993; Paché and Paraponaris, 1993). The company-network as a new organizational type brings ICT to mind, questioning the nature of the relationships that exist between organization and technology (Rallet, 1989; Scott-Morton, 1991; Tapscott and Caston, 1994; Castell, 1998). The question of the relationships between technology and the social system (organization) is certainly not new: it forms the foundation upon which the work of the sociotechnical approach was developed (Rojot and Bergman, 1989). However, while the nature of these relationships was widely accepted in general discourse, the specific methods for this interaction process remained largely unknown, particularly among managers and decision-makers (Markus and Robey, 1988).

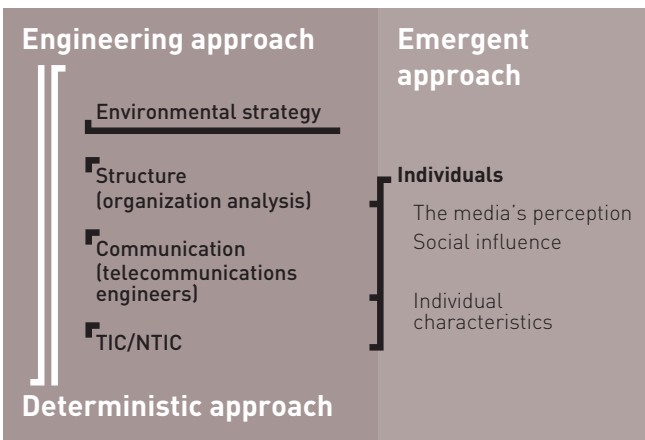
The groupware example is an interesting one: in specific terms, after a gestation period in the world of applied computer science research, groupware products began to develop in the North American market beginning in 1991, their opportune appearance facilitating a transformation in the companies that used them through three key steps (Chaffey, 1998; Ciborra, 1996a, 1996b; Manganelli and Klein, 1996; Hamer and Champy, 1993, Scott-Morton, 1991):

- The groupware benefited from organizations re-examining the way they did business, affected by an economic crisis and a move towards deregulation, which pushed large companies to seek greater efficiency and flexibility. In a very pragmatic manner, the companies subject to these needs to introduce and implement changes, largely made use of the available means (CSCW), which included groupware tools.
- These companies quickly became aware of the role that the groupware could play in redefining business processes and in decompartmentalizing the company. Groupware, but also other technologies, played a vital role in designing these transformations called Business Process Reengineering (BPR).

- Examples of BPR then became frequent, and the companies that used them became aware of the obstacles that prevented the method from being generalized in order to create organizations that were able to re-evaluate their position quickly (today we could say agile companies, Pal and Pantaleo, 2005). Change became the way of operating, becoming as common as the very opposition to change that had characterized the companies a few years before.

Therefore, the groupware tools – and ICT in general! – emerged to facilitate change, an entire set of tools were mobilized in the quest for efficiency. However, NICT were not “poured out” to ensure the company’s transformation!

In an article that has now become famous, Markus and Robey (1988) proposed a typology that in principle identified three major epistemological postures (world views) that provided an understanding of the nature of interactions between ITCs and organizations. They sought to synthesize Pfeffer’s contributions (1982) on causal articulation and the level of analysis, as well as the contributions from Mohr (1982) on logical structure. In short, causal articulation refers to the nature of the causality. Was the initial impetus exogenous or endogenous? Either external forces are the cause for change (technological imperative), or humans act voluntarily to accomplish the set objectives (organizational imperative), or the change is the result of interactions between humans and the events (emergence perspective). The logical structure, on the other hand, refers to the time horizon of the theory (static or dynamic) and to the assumptions on the causal relationship.



*ICT-Organization relationships: three distinct world views
Source: Rowe, F. et D. Struck (1995)*

These assumptions are similar to those found in the variance and process theories. The causes are either connected to effects by an invariant relationship with necessary and sufficient conditions, or the conditions are necessary, but are not sufficient for creating the effect

after a certain period of time. Therefore, the form taken de facto by the causal articulation is the major epistemological question behind the choices in the organization’s technology-structure interaction model and, more generally speaking, provides a better understanding of the different academic positions.

In the **deterministic approach**, changes in the environment require technologies to be adopted that feature technical characteristics that inevitably have specific impacts on the organization. The determination is therefore technological in that the initial impetus is primarily technical and originates externally. This is the case for radical innovations that produce effects that are immediately visible from the moment the technology is introduced. This perspective is generally discussed using historical analysis that highlights a strong connection between organizational transformations and the spread of ICT, or by using theoretical constructions based on the properties of the ICT (Huber, 1990; Sproull and Kiesler, 1986; Foster, 1984).

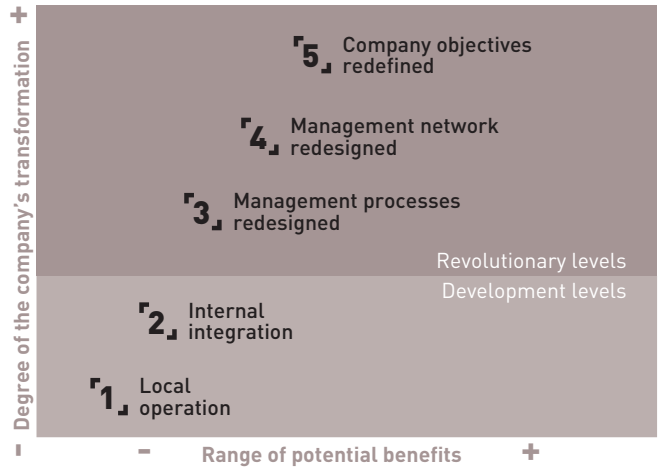
In the **engineering approach**, the ICT cannot be applied to the organization because they were the product of this organization. This view is aimed at identifying the organization’s structural attributes and the ICT that are best suited to these attributes: the ICT are dependent on the design choices. The organization is seen as a system for processing information, in which efficiency and effectiveness require that a suitable balance be found between the information processing capacity and the information load generated by the environment, in other words, the information processing needs (Tushman & Nadler, 1978; Daft and Lengel, 1986; Daft and MacIntosh, 1978). While this approach boasts the capacity of managing the completed action, most of the time the engineering approach uses the contextual determinism of the structural contingency theories.

Finally, the view of the **emergent approach**

is that the true issue is not that of the technology-structure relationship, but rather the users' role (Contractor and Eisenberg, 1990; Fulk, 1993). In the context of this type of analysis, the users' personal characteristics, their perception of the tools and the social influences these tools create (Alter, 1984, 1987, 1989) are what explain the uses and the associated organizational transformations (Jameux, 1989). By reintroducing the aspect of individuals, their interpretations and the corporate culture in the communication field, this approach requires an attentive observation of how the ICT are actually used. Inspired in particular by work by Weick (1969), this approach is focused on the in-depth analysis of processes, such as the perception and creation of meaning in order to provide and understanding of organizational phenomena.

The nature of the technological and organizational transformations that take place within the company are often more opaque and are more difficult to interpret than those that take place in civil society. It is therefore more difficult to understand these transformations: the external statistical tracking is often insufficient in providing an understanding of the complex and multifaceted developments. Only direct in situ surveys can report on these developments, providing an understanding and the ability to interpret a phenomenon that remains unique in nature. It was precisely this "*repetition of uniqueness*" that enabled Venkatraman (1995) to conceptualize, based on approximately ten case studies carried out in the 1990s, the different organization levels found in companies as a result of the ITCs.

The notion of **digital transformation** that emerged in 2000 is increasingly significant due to the speed of the transformation underway (see above). Companies are driven to rethink their processes and the way they interact with stakeholders due to pressure from new entrants, the need to adapt to new consumer behaviors, or in order to make the most of technological tools in the areas of innovation and productivity.



The five levels of reorganization caused by the information technologies

(Source: Venkatraman, 1995)

It should be noted that, at this time, managers and decision makers often have limited knowledge of what the digital transformation is, what it represents, and the tools and methods that can allow them to take advantage of this transformation (see Harvard Business Review ASR, 2015). Furthermore, the Harvard report points out the lack of agility of IT departments in large companies and their lack of strategic vision. In France, a significant opposition to change can be observed in many companies as they are faced with a future full of unexpected changes. The (pathological) attitude that is often adopted would say "*since we don't know exactly what's coming, and everything is going so fast, we prefer not to do anything!*". However, a company that does nothing will die! The main issue is to become a participant in this change and work to make the most of the potential these unexpected changes represent. In the unexpected, companies must focus on the opportunities rather than the threats. This issue of the posture and mindset that managers and leaders adopt in reaction to change is a significant academic research focus in the area of strategy, because digital transformation is above all a question of strategy (Kane, Palmer, Phillips, Kiron and Buckley, 2015).

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ENTREPRENEURSHIP IN 2050? ┘

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In order to study the future of companies from a more forward-looking angle, as has been requested of me, we must widen the perspective beyond that of the company itself, to consider the world in which companies develop.

To answer such a question ("What will a corporation look like in 2050?"), futurist Stowe Boyd bases his scenarios for development on the possible bifurcations of three structuring trends: the rise in inequality and its detrimental effects on the social contract (but not necessarily on financing for entrepreneurship and innovation); climate change and its advanced effects (perhaps also the effects of the ambitious strategies designed to fight it); progress in artificial intelligence and robotics, and their impact on the working world (which, however, depends on the importance we choose to give them).

Boyd's three scenarios are worth reading and we will not go into more detail here. However, they give rise to four questions that to me, seem essential, and which should be taken up by research: the future of the entity of the "company" itself, the contradictory and ambiguous contributions made by digital technology, the persisting conflicts in and around the company, and the act of entrepreneurship in a finished world.

► What do we mean by the term "company"?

It seems obvious, today, that the company is the basic unit in production and in creating economic value. This has not always been the case: the family, the village, the kingdom, the abbey, the guild, the corporation... formerly played a much greater role than today. Tomorrow, however, and even today: what can be done about "non-organizations" such as Wikipedia, or a group creating free software, Bitcoin "miners", or "digital workers" feeding content to social platforms?

The mystique surrounding the company goes beyond simple value creation. In their book entitled *Réinventer l'entreprise*, Blanche Ségrestin and Armand Hatchuel write: "*Invented a century ago, the "company" embodies technical inventiveness, organized work, and a space for social negotiation. Its development was confused with collective progress.*" But this mystique has been replaced by a development of almost strictly functional organizations (which are not always companies), focusing on one of the "layers" that made up a company until now:

- *Distributed Autonomous Organizations* (DAO), propose measures for creating and distributing economic value, founded with the help of blockchain technology, entirely organized around "intelligent contracts" (which self-create and self-check, without intermediaries): "*By encoding the company's mission, we create an inviolable contract which generates turnover, pays people for achieving tasks, mobilizes the equipment it needs to run, and all of this without human intervention.*"²
- A place to work: as provided by the growing number of ever more specialized co-working spaces, with no clear connection with

- ❑ employers who appreciate the gain in square meters, all the while worrying about the breakdown in their relationship with employees.
- ❑ A work community: cooperative organizations bring independent workers together, paying them and providing them with a salary, allowing them to escape their solitude and at the same time keep working on assignments for their clients. Temporary work providers also play this role, and are beginning to take their role in the personal development of the individuals they assign work to more seriously, to the point where some senior executives see this form of work as a desirable alternative to more permanent, but also more confining forms.
- ❑ A space for innovation or project work: many startups are created around such a project and have but one goal: to sell to a bigger group as soon as possible. This exempts them from creating a corporate culture, thinking about their employees' development, or being too concerned with their clients or other "stakeholders", etc.
- ❑ There are now countless companies specialized in outsourcing certain roles for their client-companies: production, logistics, accounting, pay, but also HR or customer service.

Are we left with the most interesting elements, strategy and design? Not always, if we are to consider the multiple collaborative innovation measures (fab labs, crowdsourcing platforms...) and matching platforms, which are taking over matching work, and therefore, to a large extent, the strategic definition of positioning.

Of course, the cases described above are often companies themselves, but there are also associations, cooperatives, or even communities with no status. In any case, what appears to dissociate and separate the "layers" which previously made up the company, could be the sign of a deep reconfiguration of the very concept of the company.

➤ What does digital technology do for companies?

It goes without saying that digital technology is the central factor in the transformation of the company. But what digital technology are we talking about? Companies started becoming computerized years ago; the concept of "strategic information technology", which refers to the use of digital technology to sustainably transform a particular market's terms of reference for the benefit of a particular company, comes from the 1980s (the canonical example at the time was that of American Airlines creating the SABRE system). However, companies now hire Chief Digital Officers responsible for "digital transformation", suggesting that IT managers (to which CDOs do not belong) are responsible for other, less technical, more everyday areas, or even that they block change.

However, both are involved in digital work, and the work done by both sides will inevitably be evident at some point, in the company's information system. Isn't there room for research here, on this internal tension in digital

technology itself, which has become evident with the event of two digital roles, one dealing with order, the other with disorder?

Particularly as the two forms are calcifying. On the one hand, computerization has never been as omnipresent, has never before encompassed all of the dimensions and moments of the company. The Internet of Things (which is not an Internet) accentuates this temptation to control everything precisely, in addition to a multitude of legal or professional regulations for traceability, impact, security, quality... On the other hand, digital technology is very clearly flexible, with constant trial and error, open-mindedness and collaboration, vague boundaries, transgression... Big data is in some ways the link between the two, using the smart element, bringing the obsession for measure and efficiency in the scale of individual processes to that of whole systems, and systematic exploration of forms of subversion of the company's initial business model.

Of course, the same scientific discipline produced the Smart Grid, ERPs and the dematerialized processes, Uber, *Mechanical Turk*, Facebook, et Thingiverse, but it is obvious that it is used by entirely different, even opposing forces.

➤ The company as a place of conflict

The story of digital technology is all too often, and all too easily, that of harmony within the company, both between the company and its environment. Thanks to digital technology we supposedly have more independent, committed employees, who perform better; lighter organization (particularly in terms of staff), which is more reactive, more efficient, and closer to its customers; customers who receive better, more personalized service, who are more attached to the brand; activity that conforms to legislation and sustainable development principles... and yet, there is as much, if not more, tension between these goals than ever before!

There are many studies showing the extent to which computerization can contradict managerial discourse on autonomy and the

order to innovate; how “dematerialization” of interpersonal channels can destroy customer relations; that digitalization in no way guarantees a reduction in the company’s ecological footprint; and the list goes on. But we only need to follow the news to see that the golden era of digital technology is coming to an end, as ever-stronger controversies appear over the effects of domination and value-tapping, which themselves are less and less concealed. Another new effect: conflicts do not only oppose employees and management (or stockholders), but also suppliers (dependent and crushed), pseudo-independents (Uber drivers), users (digital labor), customers (of Monsanto, for example), creators of apps removed from Apple Store, other stakeholders, etc.

The power ratio, and even conflict, as a key element in becoming a company, will need to be taken seriously once again. Work on content and future forms of “social dialogue”. But we are also seeing companies “choose sides”: some are explicitly concerned about their shareholders only (starting with DAOs), others focus on their partners (starting with manufacturing cooperatives), still others focus on the public interest (social entrepreneurship is fast-growing, causing uneasiness with the former “social and solidarity economy”). Whereas the scale of certain directors’ salaries can also be seen as a sign of the return to favor of this “technostructure” denounced by Galbraith, who is only concerned with long term company growth, as free as possible from stakeholders and partners’ wishes.

► Entrepreneurship and manufacturing in a finished world.

Finally, the celebration of innovation and digital transformation ignores, or perhaps deals too briefly with the two structuring trends for the coming decades, ageing populations and climate change (both through its effects and through the fight to limit these effects). We cannot simply get rid of these problems by attributing them to “social responsibility”: either we carry

on, business as usual, heading most probably towards prolonged and cruel crises, or we manage to deeply transform our production, consumption, social, training, health systems, amongst others.

Regarding climate change, for example, keeping global warming below 2°C requires dividing our greenhouse gas emissions by at least four by 2050 – which means making them nil, or even negative in a great number of sectors. This is an extraordinarily ambitious and difficult goal. As a guide, energy efficiency in our production has increased by 35% in 40 years³: if nothing else were to change, it would have to rise by 300% in 35 years!

Suffice to say that we will not be able to settle for technical adjustments. To meet such a challenge, we need new ways of deciding, acting, producing, consuming, exchanging, living... the increasingly frequent use of the word “transition” is not insignificant: it describes *“the shift from the starting point of a system (or “régime”, which has become unstable, to an arrival point that is stable, or at least appropriate for the current conditions at the time”*⁴. “A transition is of course a comprehensive change affecting economic, political and social models at once. Technology plays a major role, but as a trigger and support for structural transformations.

A transition is of course a comprehensive change affecting economic, political and social models at once. Technology plays a major role, but as a trigger and support for structural transformations.

Today’s company is neither equipped, nor assisted in making such a big change. It does not know how to measure what we call the “externalities” of its sector: how can they be really internalized, as deeply as financial measures? It has an idealistic view of a dynamic, committed, creative, independent, multi-tasking employee: how can it deal with its future octogenarian employees? Nothing but the law, or the pressure of public opinion can encourage or help the company to prepare its ecological and transgenerational transition, especially if these factors are also synonymous with slower growth and less profit. Research could shed light on this area, highlight several possibilities, identify the great choices that will need to be made.

The scale of the changes to come means that management researchers must look beyond their discipline, or even rework it.

Tomorrow's company is not a more digital, more effective, more whatever version of today's company. More than this, it is a collection of diverse and new forms of organization, economic and social relations, ways of seeing, manufacturing and selling things. As the foundation of managerial thinking is changing, the rest must follow. Management science has always been more prescriptive, closer to the action than other disciplines. The flipside being that it will not be able to sit back and watch these changes: it will have to anticipate them, and in doing so take risks, of course, intellectual ones, but undoubtedly also entrepreneurial ones.

¹ "Imagining A Corporation In 2050", Backchannel, 2015 - <https://backchannel.com/what-will-a-corporation-look-like-in-2050-281978852fc4>

² Buterin, Vitalik, "Bootstrapping A Decentralized Autonomous Corporation". Bitcoin Magazine, 2013

³ Jean-Marc Jancovici, "L'équation de Kaya", 2014 - <http://www.manicore.com/documentation/serre/kaya.html>

⁴ Fing, Questions Numériques, édition 2015 "Transitions", <http://reseau.fing.org/qntransitions>

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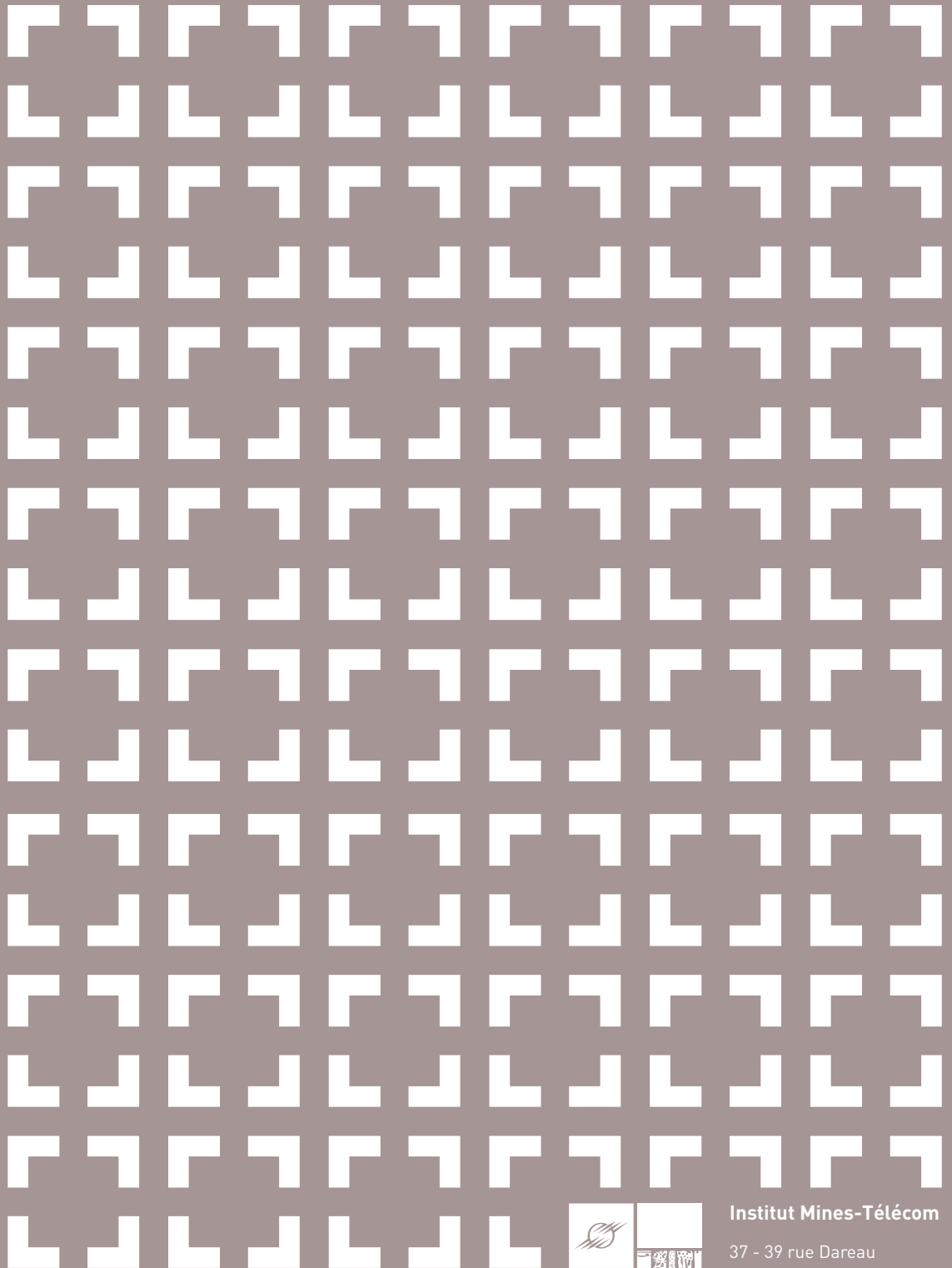
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