

SCIENCE, SOCIETY AND NEW TECHNOLOGIES SERIES
TECHNOLOGICAL PROSPECTS AND SOCIAL APPLICATIONS SET



Volume 1

Society 5.0

*Industry of the Future,
Technologies, Methods and Tools*

Bruno Salgues

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WILEY

Society 5.0

Technological Prospects and Social Applications Set

coordinated by
Bruno Salgues

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Foreword

Society 5.0 Revealed

Prometheus and Atlas were right, one in having taught technology to people, and the other, in having skillfully managed the cities of his territory, Atlantis. Zeus was wrong in condemning them, one to have his liver eaten out every day after it grew back again during the night, and the other, to hold the world on his shoulders.

One day, “Atlas shrugged” and the world was shaken. *Atlas shrugged* is the voluminous novel written by the famous philosopher Ayn Rand in 1957. There, she summarizes her thesis, telling the story of the American economic collapse, when exploited businessmen under the control of demagogic politicians decided to give up. However, as it happens in every good American novel, it concludes on an optimistic note, where the head of the striker technologists, John Galt, comes out from his secret valley with his partner, saying: “Let’s go rebuild the world”.

This book by Professor Bruno Salgues is almost as dense. It deals with the same subject: the society we are creating. However, it is not a novel. He tackles all the facets of technologies that shape the world: of course the industrial revolution 4.0, but also new marketing approaches as well as the evolution of business management. This book transforms the weak signals that we all subtly feel into a superb synthesis of the societal evolution that is currently taking place.

Twenty-five years ago, at a national conference devoted to passive electronic components, Professor Bruno Salgues, whom I had never seen, spoke up and made relevant observations to the presentation of an industrialist, who was nonetheless an expert in his field. Puzzled by his remarks, I went to see him at the end of the conference to propose a later meeting and continue with his analysis. His reply was: “First, I would like to see your company and your factories, before discussing in detail”. That was done, and since then, we have regularly been seeing each other and discussing.

I still remember our joint trip to China in 2005, to visit an electronic equipment show. While I was paying attention to the products competing against mine, that Chinese firms were starting to manufacture, he was picking up faint signals and explaining the future trends he could deduce from them. Impressive!

This book, *Society 5.0*, is a societal summary, as interesting for a Master’s degree student, who will be able to develop a personal vision, as it can be for an experienced manager, who will find sources of inspiration.

I wish you an enjoyable read, especially considering that the concrete examples told throughout these pages could be the tales of Greek mythology of the present-day.

Joseph PUZO¹

¹ CEO of AXON’ CABLE group, a member of the steering committee of the national-extent project known as Future Industry (*Industrie du futur*). In 1980, AXON’ used to be a SME of 100 employees, in charge of standard cable manufacture. In 2018, it has become a transnational (a particular multinational organization) SME of 2,100 employees, designing and providing innovative cabling solutions for the space conquest of the Moon, Mars and beyond, for the super magnets that enabled the discovery of the Higgs boson, for surgery, for the flight controls of many planes, for environmental remediation and for car airbags.

Preface

Together with the one I wrote a few years ago on mobile phones¹, this book has been one of the most difficult ones to write and to conceive, because in this developing society 5.0, everything is interconnected. It foresees the birth of the “firms of the future”, which are the topic of many speeches and white papers, many of which are not up to the mark. This type of society relies on a series of concepts: automation, dematerialization, digitization, industrialization and “servitization“, which shake up economic and political life. These concepts are at the origin of new actors, the death of powerful and recognized organizations, while other organizations see how their mutation takes place, a mutation which is itself complex, brutal, but very real.

Society 5.0 involves an important social change. It results from the birth of technologies, which have become mature and have been released in record times, something that no other technology had done in the previous century.

Had Paul Valéry foreseen the arrival of society 5.0? He wrote:

“What can result from this great debauchery [...] the amount of publications, their daily frequency, the flow of things which are printed and published, model judgment and impressions from morning to night, mix them up, and transform our brains into a truly gray substance, where nothing lasts, nothing dominates,

¹ Bruno Salgues, *Les Télécoms mobiles*, Hermes Science, Paris, 1995.

and we experience the strange impression of the monotony of novelty and the boredom of wonders and extremes”.²

The theme of the informational deluge and infobesity, which imposes an adequate processing of information, will be a constant in this book. As a corollary and an opposing element, boredom will be one of the elements of the suggested managerial approach.

Let us quote Paul Valéry once more:

“But the individual also means the freedom of the mind. Now, we have seen that this freedom (in its highest sense) becomes illusory by the mere effect of modern life. We are influenced, harassed, made stupid, vulnerable to all the contradictions, to all the dissonances that tear the environment of the present civilization. The individual is already compromised even before the State has fully assimilated him”.³

I would like to thank those who had the courage to read, amend and criticize the first drafts of this book, including Alexis, Joseph, Monique-Marie and Philippe.

This book is not an anti-manual of politics, management or technology marketing, or a theory of innovation. It is a book that simultaneously wishes to fight against the excesses of this society 5.0 which is unveiling, a society that is often misunderstood, and to bet on introducing the ideas that make it up, as well as its associated technologies, all working for the improvement of society. This book may appear as a manual full of philosophy or definitions, and I do apologize for this beforehand to some readers, but that is the way it is.

Bruno SALGUES
June 2018

2 Translation of French quote. Quoted from Paul Valéry in Jean-Pierre Siméon, *La Poésie sauvera le monde*, p. 36, Le Passeur Éditeur, Paris, 2015.

3 Translation of French quote. Paul Valéry in “*Le bilan de l’intelligence*”, extracted from a conference delivered in 1935, published by Allia Editions in 2011.

Introduction

Preamble for Understanding Society 5.0

In June 2017, Paul Reyntjens, financial policy officer for De Lork association, published on his LinkedIn profile a text in French which inspired this preamble¹. The quotes for this introduction have been extracted and translated from there.

“In 1998, Kodak had 170,000 employees and sold 85% of photo paper in the world. In a few years, their turnover collapsed and Kodak went bankrupt. What happened to Kodak will happen to many companies in the next 10 years and people do not see it coming.

In 1998, would you have thought that 3 years later you would never be able to take pictures on film paper again?”

It should be noted that these empire disappearances were not the exclusive fate for the firms of that generation: AOL, Lycos, Yahoo! and ouiEurope did not have the same success, although for some time they were the “stars” of the new economy, which was the term used at the time of their launch. Photo cameras and digital cameras were invented in the 1970s, notably by Kodak. In their beginnings, they had a poor-quality resolution, according to photographers. They barely had 10,000 pixels, whereas now they have tens of millions. As usually happens with all new technologies, these devices were disappointing for a long time. They even seemed unusable. Some gurus were very clear and anticipated that these would not succeed. However,

¹ Available at the following address: <https://fr.linkedin.com/pulse/tres-interessant-%C3%A0-lire-le-monde-%C3%A9value-quel-paul-reyntjens>.

the reality is different. They first replaced conventional technologies, and worse, they became better! All these technologies are characterized by two “occult” forces, which are digitalization and dematerialization.

Classical economy, that of society 1.0, was based on agriculture.

“In the future, there will be a farmer robot valued at \$100. Farmers in the third world will be able to manage their fields, instead of working all day long. Hydroponics will require much less water. Veal meat produced in laboratories is already available and will become cheaper than natural veal by 2018. Currently, 30% of the entire farmland is used for livestock. Imagine if we did not need it anymore. Several new companies will soon launch insect proteins on the marketplace. These are richer than animal proteins. They will be labeled alternative sources of protein”.

Agriculture, the foundation for society 2.0, is currently undergoing important changes, which will have to be studied to see its applications in society 5.0. This agrarian society was called into question by the industrial society, that of society 3.0.

The strength of industrial society lies in the power provided by forms of energy such as electricity, which revolutionized the industry. For example, with the arrival of electricity, the textile industry no longer needed to be placed near energy sources. These sources were coal in the Roubaix area in France, or Hesse in Germany, and electric dams in the southern foothills of the *Massif Central*. The location of industries depended on these sources. Since the topic is fashionable, many academics who have never worked at a factory have recently dealt with this subject with more or less success.

“Electricity will become incredibly clean and inexpensive. Over the past 30 years, solar production has been growing exponentially. We are only beginning to see the impact. Last year, there was more energy produced by solar sources than from fossil sources, worldwide. The price of solar energy will decrease so much that every coal mine will stop being exploited by 2025.

Cheap electricity means plenty of water at a low price. Desalination now only needs 2 kWh per cubic meter. In the

majority of cases, it is not water which is uncommon, but it is drinking water that is. Imagine what could be possible if everyone could have unlimited drinking water for almost anything”.

The emerging society will free itself from the problems associated with energy location and will be able to relocate its production sources thanks to the information society. Society 4.0, the information society, which came after the industrial society, is the basis for this new society that we are studying. Thus, the fourth industrial revolution will transform most of the traditional industries between the next 5 and 10 years, by means of information and communication technologies and knowledge-related tools. Among these technologies, we can mention artificial intelligence, robotics and 3D printing.

I.1. Artificial intelligence

Regarding artificial intelligence, computing tools, the possibilities of memories and algorithms are becoming more and more efficient, and this is happening exponentially. Besides, there are more and more effective methodologies for understanding the world. After having beaten chess players in the 1970s due to “logical errors” in programs, a computer finally beat the best player of Go in 2016. In artificial intelligence, errors are beneficial and in general, precision is symbolic.

“In the United States, young lawyers find it difficult to be employed. This is because IBM’s Watson computer can provide legal advice in a few seconds, for more or less complicated cases, all with 90% accuracy, compared to 70% for humans. So, if you are studying Law, forget it right away. In the future, there will be 90% fewer lawyers, only those who are specialized will survive.

The Watson computer is already helping to diagnose cancer with 4 times more accuracy than humans”.

The holder of this singularity believes that, in 2030, a computer will be able to compete against human intelligence. Thus far, face recognition software has proved superior to human capabilities, and it can be used for biometric access recognition, for searching people in applications like Facebook, and, as a matter of fact, has dethroned professional physiognomists.

I.2. 3D printing

3D printing makes it possible to print everything, from the smallest items – a few nanometers – to houses. This kind of technology plays an important role in the evolution of goods production.

“In 10 years, the price of basic 3D printers has gone from \$18,000 to \$400. At the same time, they have become 100 times faster. All major shoe manufacturers have started to print shoes. In airports, spare parts are already printed in 3D. The space station has a printer which does not need to have as many spare parts as before. By the end of 2017, new smartphones will have been able to digitize in 3D. Thus, it is possible to digitize your feet and print perfectly adapted shoes at home.

In China, a 3D building of 6 complete floors has already been printed. By 2027, 10% of everything that will be produced will be done by 3D printer”.

I.3. Platform economy and “servitization”

The birth of the platform economy is a reality. Unfortunately, this economy has been the object of conspicuous ignorance on the part of theoreticians. This new economy is characterized by the passage from a possession-oriented economy to a new economy, featuring a form of “servitization”, a phenomenon which we will describe in this book. This economy of the platform is wider than that of sharing.

“Uber is simply a software tool. Even though it has no cars, Uber has become the largest taxi company in the world. Airbnb is currently the largest hotel chain in the world, despite the fact that it does not have any facilities”.

Society 5.0, Its Logic and Its Construction

The main theme of this book is the description of society and of everything which surrounds it, that is to say, what has been defined as the fifth societal wave.

1.1. The origins of society 5.0

The term “society 5.0” first appeared in Japan in 2016. Since then, it has been spreading and its underlying concepts continue to be shaped.

Society 5.0 is a term used in the *Fifth Science and Technology Basic Plan*, reviewed by the Japanese Government’s Council for Science, Technology, and Innovation. It was enforced by the Japanese Cabinet of Ministers in January 2016.

DEFINITION. “Society 5.0” can be defined as a “society of intelligence”, in which physical space and cyberspace are strongly integrated.

Society 5.0 emerged from the hunter-gatherer society, the agricultural society, the industrial society and the information society. Although focused on humanity, 5.0 refers to a new type of society where innovation in science and technology occupies a prominent place, with the aim of balancing social and societal issues that need to be solved, while ensuring economic development. Although it borrows many of its elements, this approach is opposed to that of the proponents of decline.

The Japanese have introduced society 5.0, by illustrating it with Figure 1.1.

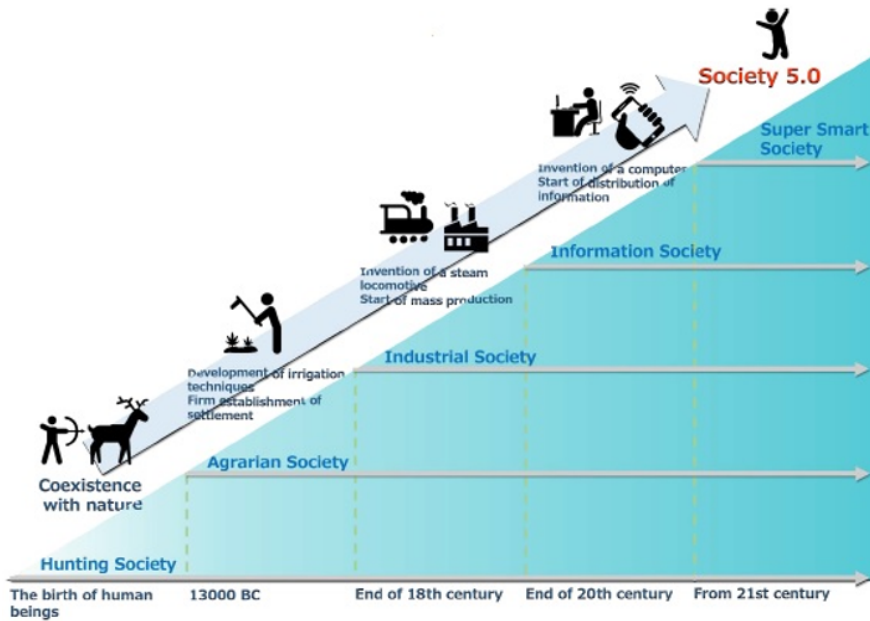


Figure 1.1. Definition of society 5.0. For a color version of the figure, see www.iste.co.uk/salgues/society.zip

The “basic plan for science and technology” is a comprehensive plan for the promotion of science and technology, decided by the Japanese Government and incorporated into a fundamental law, which will be positioned in the next decade, in the same way as the European H2020 bid solicitations. The fifth basic plan (2017–2021) is the first one for Japanese governments. This law establishes a Council for Science, Technology, and Innovation (CSTI). Thanks to an array of different measures, it strongly favors innovation policies for science and technology. The plan has been brought forward as a model for a wide range of stakeholders, including government, the university environment, the industry and citizens, so as to

co-build the society of tomorrow. It also aims to guide Japan so that it can become “the most favorable country for innovation”.

This plan is sharply different from the innovative strategic axes proposed by the French Minister of Economy, Arnaud Montebourg, and amended by his successor, Emmanuel Macron. In Europe, countries have defined industrialization axes in general, and this was certainly the case in France. The Ministry for Productive Recovery in office in those times translated the priorities of the French industrial policy into 34 plans, which were designed for coordinating the actions of public actors and companies. The announced aim was to favor the emergence of the products of the future under the label “Made in France”.

- Big Data
- Cloud computing
- Connected objects
- Augmented reality
- Embedded software and embedded systems
- Contactless services
- E-education
- Digital Hospitals
- Cybersecurity
- Nanoelectronics
- Robotics
- Supercomputers
- Innovation in the food industry
- TGV of the future
- Two liters per 100 km vehicle for all
- Autopilot vehicles
- Electric recharging terminals
- Battery autonomy and power

- Electric planes and a new generation of aircrafts
- Electrically propelled satellites
- Heavy load airships
- Ecological ships
- Renewable energies
- Smart electrical networks
- Water quality and management of scarcity
- Medical biotechnologies
- Innovative medical devices
- Telecommunications sovereignty
- Wood industry
- Recycling and green materials
- Thermal renovation of buildings
- Green chemistry and biofuel
- Technical and intelligent textiles
- Factory of the future

Box 1.1. *The initial 34 industrial plans*

When his successor, Emmanuel Macron, took office, he reduced Montebourg's industrial plans from 34 to 10. The plan was associated with goals. These 10 plans were broken down into 9 specific plans, and 1 particular and transversal plan called "*Usine du future*" ("Factory of the future"). This approach was considered more important than others. The "Industry of the future" approach sought to develop a technological offer, by accompanying the transformation of companies, training employees, and with a strong emphasis on international cooperation.

Plan	Contents	Goals
New resources	Biosource and recycled materials	2020: to double the volume of raw material of vegetal origin in the French chemical industry, increase nondangerous waste recycling by 50%
Sustainable city	Water, smart grid, thermal renovation, wood industry	2020: 100 billion euros turnover and more than 110,000 territorialized jobs
Ecological mobility	2 L/100 vehicle, charging station, autonomous vehicle, energy storage	2016: 20,000 recharge stations ¹ 2020: 30% decrease in CO ₂ emissions of new vehicles manufactured in France
Transport of the future	TGV, ecological ships, electric planes, electric airships and drones	2020: to sell 80 electrically run school-planes, undated 50% decrease in energy consumption of buildings
Medicine of the future	Digital health, medical biotechnologies, medical devices	2017: 50,000 patients with a chronic disease under medical remote monitoring ² 2025: to reestablish the French trade balance in terms of medical technology, whose current deficit is equivalent to 1 billion euros
Data economy	Big Data, supercomputer, Cloud Computing	2020: to create and consolidate 137,000 jobs thanks to Big Data, to master the critical technology of exascale supercomputers, which make it possible to perform 1 billion operations per second
Intelligent objects	Connected objects, robotics, augmented reality, contactless services, innovative textiles	2020: 8 million customers using mobile payment methods, to deploy an interoperable ticketing app to be used in 50% of cities with more than 200,000 inhabitants

¹ According to data provided by the roaming consortium for electric mobility recharge GIREVE (*Groupement pour l'itinérance des recharges électriques de véhicules*), by the end of 2016, in France, there were 15,883 public parking places for recharging electric vehicles, disseminated in 5,297 stations. For more information: <http://www.gireve.com>.

² If we only take heart failure into account, 350,000 pacemakers and 60,000 connectable automatic defibrillators are implanted in France. However, only 40,000 of these devices can be activated by a remote monitoring system.

Plan	Contents	Goals
Digital trust	Cybersecurity, telecommunications sovereignty, nanoelectronics, embedded systems, embedded software, electrically powered spacecraft propulsion	2020: to develop 5G infrastructure per mile, annual growth of 30% in the cybersecurity export market share, half of all sales in electric satellites
Intelligent food	Functional food, packaging of the future, lasting cold and food security	2017: modernization of 30% of industrial slaughterhouses and recruitment of 90,000 people for the sector

Table 1.1. *Emmanuel Macron’s nine specific plans*

1.2. The ancient ages

Society 5.0 can be defined by its uses and by its societal leading elements.

After the 18th Century and the birth of the industrial revolution, innovations followed one another.

1771: the beginning of the Industrial Revolution with the appearance of machines, factories and canals.

1829: steam, coal, steel and train became the four predominant development factors.

1875: steel and hard engineering encouraged the birth of new development stars: electricity, chemistry, civil engineering and shipbuilding. Governments sponsored engineering schools in these fields.

1908: the car became complementary to water and railway means of transport. It quickly required oil resources, which led to the emergence of complementary industries, such as petrochemistry and mass production.

1971: the information and communication technology industry fed multiple economic sectors, leading not only to the birth of a semiconductor industry, but more fundamentally to the world of software and applications.