



# The Coexistence of Diverse Definitions for the 4<sup>th</sup> Industrial Revolution: A Multidisciplinary Analysis

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**Abstract.** The term fourth industrial revolution is a notion used with increasing frequency, especially when it comes to descriptions of contemporary technological and economic developments. However, the term contains a problematic aspect: it does not have one unique definition, but several, and these vary to such an extent that we even find various opposing positions. The lack of definition extends not only to the mention of the following revolutions, but even to the previous one. The causes of this variation can be found both in the speed of current technological development and its effects, and in the complexity of the notions of revolution and particularly of industry. The latter is a concept in which, among others, economic criteria, production logics, social structures and even cultural processes converge. Faced with this breadth of disciplinary fields, and in order to adequately describe and understand contemporary socio-technological processes, it becomes evident that it is necessary to review the definitions of current industrial revolutions and paradigms from a multidisciplinary approach.

In this article, we present an investigation on the notions of industrial revolution from a cultural and phenomenological perspective, in order to detect the links between technological developments and their cultural perception. The goal will not be to propose new definitions, but rather to understand the processes behind their set up. The notions of philosophy of technology, as well as theory of media and culture, seek to help understand the diversity and lack of definition of these denominations as a natural and perhaps insurmountable phenomenon.

**Keywords:** Culture · Industrial Revolution · Industry 4.0 · Technology

## 1 Introduction

We read frequently that we are in the 4th industrial revolution. But the definitions of this vary; mark, perhaps, the fourth industrial revolution, the onset of the Internet of things (IoT) and its autonomy, thanks to artificial intelligence (AI)? Or is it rather a revolution due to the reversing of production conditions driven by 3D printing and the Maker culture? It is evident that in recent years there is a greater use of the 'Industrial Revolution' denomination to describe changes in contemporary forms of production. This is especially reflected in the various definitions of the 4th industrial revolution. We

not only find a lack of consensus, but even contradictory positions regarding definition and starting points. The same applies not only to claims about a 5th, but even to the classification of the 3rd revolution.

Considering that ‘revolution’ usually describes historically spaced radical transformations, the question arises as to whether the changes merit this denomination, and above all, why their use is sought.

In the discussion about relevance, a classical reference for the classification of significant cultural changes could be the concept of Kuhn regarding scientific paradigms. In an approach different to the philosophy of science, we consider the contributions of the philosophy of technology of interest, which relate to the speed of technological evolution, and also, in view of the massive effect of digital media and the scale of its cultural impacts, media theory and culturology.

Based on these results, we will try to understand the diversity of disciplinary areas in which the term is used, to reach a notion of such multiplicity and indefiniteness, perhaps unavoidable to a certain extent.

## 2 Analysis of the Evolution of the Term

### 2.1 A Chronology that Evolves Towards Indefinition

The first two industrial revolutions are phenomena whose dating and repercussions are clearly defined and delimited. The beginning of the first one, based on the steam engine, is set in 1776 and the beginning of the second, related to electricity, is placed in 1900 by Georges Friedman in his book from 1936 *La crise de progress*. Even though they are both regarding technical advances, definitions and descriptions always imply changes in the various fields involved in the notion of industry: forms of production, economic systems, communication dynamics, social relations, and cultural values. Where there does not seem to be the same consensus in definition and starting point is in the third industrial revolution, since there are positions that date its beginning in the 1960s and others argue it is just now happening. There is consensus though in relating this one to the computer, that is to say, to the possibilities of microelectronics and thus information technology to automate production processes [1, 2], but still its scope delimitation is unclear. There are those like Bell, who place it at the end of the 1960s with the arrival of computers [3] while others place it at the beginning of the Internet in 1989 [4]. There are even those who see the digital age – which beginning can be defined not with the appearance of microcontrollers nor internet but as the moment in which more information is communicated digitally (1993) or more data is recorded digitally than analogically (2002) – as a second stage of the third revolution, and not as a transformation of its own. Lorberg, after showing the diversity of definitions for each phase and each revolution, opts for the latter position [1]. The lack of consensus is even more evident regarding the definition of the fourth industrial revolution - if its existence is even accepted. Its first mention goes back to 1985 [5]. According to Schwab, who addresses it at the World Economic Forum in 2017, although the 3rd revolution is based on information technologies, the 4th is based on the dynamics fostered by the deeper digitization of society [6]. In turn, it can be observed that although the definition of industry 4.0 is accepted in various fields, this does not always imply acceptance of the fourth industrial

revolution, so the numbering of industry and its revolutions does not necessarily go hand in hand. For example, various definitions of the third industrial revolution contain elements ascribed to Industry 4.0. It is quite likely that we will appreciate the same desynchronization regarding the notion of Industry 5.0 announced by the European Commission in 2021 [8].

Just as there are differences about whether the internet marks the beginning of a fourth one or not, or whether it marks the beginning of the third instead of the fourth, we find positions that affirm that the beginning of that fourth revolution would be other phenomena. For example, the integration in production of greater automation of autonomous agents, such as the Internet of Things (IOT) is associated as an indicator of the fourth revolution [2, 6], and, related with this, of cyber-physical systems in production processes [8]. Another perspective is the observation of a movement more associated with forms of production and ideation than with the development of technological devices itself: as Wakefield mentions, the maker and DoItYourself culture can denote a home-made revolution [9]. She also associates Marx's definition regarding 'putting the means of production in the hands of the workers' with phenomena such as open hardware, 3D printing, etc. This refers to Anderson's proposal, who describes co-creation and co-financing dynamics – as related to the empowerment derived from the hardware and know-how in the construction of devices – as change factors that lead to a new revolution [10]. However, it should be noted that Anderson affirms that this possibility of digital manufacturing would be the third industrial revolution since, for him, digital publishing would have been the second one [10].

Some ways to classify the revolutions use the human body as a metaphor: if the first one with the steam engine emulated the muscles, the second with electricity and its connections emulated the nerves and their linkages [11]. Following this metaphor of evolution, we could say that the third emulates the brain with its memory and its processing, and would therefore be the computer, while the fourth emulates the creation of language and its socialization, and thus corresponds to the interconnection and inter-communication of IOT/AI. According to these metaphors, the following could emulate what writing meant in human development and perhaps even the generation of a new autonomous intelligence.

However, it is not our intention to arrive at a definition of what is the third and fourth industrial revolutions, but rather to verify the multiplicity of statements regarding both and to try to explain the existence of this plurality.

## 2.2 The Possible Causes of the Ambiguity

Given the diversity of positions of whether there is a fourth revolution or whether the same phenomenon marks the beginning of the third or the fourth, and the variety of phenomena that is adjudged as triggering milestones of the last two, it is worth wondering what is it that causes this profusion of definitions. It is clear we live in a time of optimism regarding technological progress, similar to the technical enthusiasm before the First World War, and that novelty and innovation are among the primary positive values of our time. This explains the inflationary use of the notion of revolution. However, reducing the causes of the observed plurality to it being a buzzword would be a rather short-sighted approach. The reasons for this multiplicity can be associated to the content itself, that

is, the characteristics of the technological evolution happening for the last decades, to the complexity of the notion of industrial revolution, as well as to current socio-cultural developments.

Many observed definitions anchor the beginnings of a revolution in one or more specific technological milestones. This in itself represents a difficulty to finding boundaries for two reasons. On the one hand, technological developments are increasingly difficult to isolate, as they intertwine. Moreover, one of the characteristics of its current development is precisely its convergence [6]. On the other hand, how do you grasp something that is so rapidly evolving? Laws such as that of the integrated circuit development by Moore have tried to describe the exponential development curve; in the face of such rapid changes in technologies, any attempt to define a technology either becomes obsolete or must include constant change. This is one of the factors that has led to dissolving the temporal distance between the beginning of a revolution and its description: if the beginning of the second one was set by Friedman three decades later, both the initial definitions of the third, Bell's and the current ones, like those of Rifkin and Anderson, set the start date in the same decade or even as simultaneous with themselves. With this, revolution is no longer a phenomenon to be defined afterwards. In other words, the technological developments that any definition of the third or fourth ones seeks to describe are still evolving, and in the face of processes whose development has not ended and which interconnect with other phases, it is possible to think of a constant, unfinished revolution. If technological changes are difficult to define, their consequences and impacts on the various areas of production and society are much more so.

We thus come to the next point: the complexity of the notion of industrial revolution. When we talk about technological evolution in relation to industry, we must keep in mind that industry is in itself a complex concept that involves much more than production devices. In their paper observing the difficulties of definition of Industry 4.0, Lee and Lim identified 31 research and application issues related to it [12]. Although we have referred to technological milestones in the description of revolutions, these are only an anchor - perhaps the most used, for being the most tangible. However, as mentioned, any description of industrial revolutions includes substantial changes in other more abstract areas. Changes in the forms of production such as mechanization, massification, flexible specialization [1], as well as their dynamics, such as conventions and competences, are often addressed. These aspects, although they are related to the means of production, also involve economic models. These in turn are related to social structures and even cultural notions and values. Other fields that are observed are forms of energy (one of the axes of Rifkin's definition), forms of transport [2] and modes of communication [13]. In short: to see an industrial revolution as primarily a technological change is to simplify the processes and impacts inherent to the term 'industry'. Let us consider that the word 'revolution' implies substantial and profound changes, and that the tangible elements are the easiest to distinguish does not imply that they are the cause of revolutions. It is also a simplification to assume that changes in society are merely their consequences; to deduce that technological changes condition cultural developments would be to fall into a techno-determinism. Production technology helps to structure productive relations and influences culture but does not condition it [14]. We have two important arguments to bear in mind here. On the one hand, the reason why a certain technology is developed

has to go beyond its being possible to develop it. Irrgang argues that the first revolution is caused in England by changes in norms and values. On the other hand, our history of revolutions is told from a certain point of view of science and progress [15].

Moreover, not only is industry a concept that goes far beyond technological developments, but rather the very notion of technology implies more than the specific physical device and its environment of construction and use, since it contains a complexity that extends towards economy, society, and culture. As Irrgang describes, various paradigms can be located within our current conception of technology. We associate with it the idea of scientific advances and, from a more engineering point of view, of construction, as well as the idea of productivity, since the first industrial revolution. Irrgang proposes to consider with greater emphasis the relationship with the user (demand, use, habits, skills), including an economic perspective. According to him, the systematic technological perspective and the historical, cultural, and socio-ecological perspective are correlative. As we see, in what he calls the era of hyper-technology, technology is deeply interwoven with aspects of our society, and it becomes difficult to delimit the technical from the cultural. Perhaps the term Techno-Social Revolution proposed by Xu [7] could be applied to any such phenomena.

### 2.3 Communication as a Vehicle of Visibilization

An obvious and important connection between technology and culture is that related to the media. Industrial revolutions can also be analysed regarding their impact in this area. Although the cultural revolutions of both writing and printing predate what we call industrial, the current ones involve the massive reproduction of image and sound – breaking the hegemony of the written word [11] –, the production and recording of heaps of information as well as global interconnection in real time. What the latter means for our culture has been widely discussed. The most current forms that intertwine realities and generate direct immersive experiences, in what Castells and Hartmann define as real virtuality [13], can also be understood as a novel paradigm. Given that these new possibilities influence cultural values as deep as our conception of reality and our certainties [16], we affirm here that Extended Reality can be seen as one own phase of the information age. And so also the media of what Mosco calls the Post-Internet era [17] acquires an unattainable complexity, which, according to Lipovetsky, is characteristic of the hypermodernity [18].

But not only are the media themselves increasingly complex and immeasurable, but the speed and consequent amount of data creates a world as varied as it is unapproachable. Rather than say Hyper-information, in the sense of excess, we have reached a point of totality of information, to which the concept of Pan-Information can be applied such as Zhu et al. Describe in a context of geographic data [19]. In this new world in which we can know all positions and perspectives, the persistence of an hegemonic position is impossible. Fruitful in this context is Nassehi's notion of the present society, which combines Luhmann's systems theory with phenomenology in his techno-social approach [20]. The society that Nassehi describes is built on a multiplicity of societies with their own realities. This does not refer to the usual differentiation between countries, but to heterogeneous systems of explanation within the same culture. If previously the same object of study could be seen from different disciplines, the current contemporary mass

of data leads to the profusion of different and coexisting perspectives on the same object, not only in the academic field. Nor is the vision and explanation of industrial and technological ecosystems exempt from this exuberance of various approaches to a single concept. And those who claim and describe the milestones of revolutions do come from many disciplines, they are definitely not just historians. This heterogeneous plurality is accepted and even cultivated. Let us think about the concept of innovation, which is characterized by proceduralism and unpredictability in reference to constant structures.

Although research communication seeks to create coherence in the academic corpus, through for example, the publication of papers in indexed journals and their reading – as long as the economic means allow it –, it is likely that the multiplicity of proposals for the definition of socio-cultural phenomena like this can be found from, and in, various disciplines. That is why a multidisciplinary approach is key to analyse this issue.

### 3 Conclusion

We have seen, in our analysis of the complexity of the notion of industrial revolution, that the milestone of one ushering in a different era appears for various reasons. One is that the affirmation of something as novel responds to the fact that renovation (versus obsolescence) is today a main cultural value, and this preponderance leads to not only saying that there is a new ecosystem, but that its emergence is radically fresh and original. This can lead to sometimes, but not always, declare what is seen as a change in the industrial paradigm as another revolution, resulting in the desynchrony between the numbering of the revolutions and that of the industrial paradigms (such as Industry 4.0). This value goes hand in hand with an enthusiasm for technological progress that is likely to be historically delimited. However, and that is the main point of this research, a probable cause is the dissolution of a one and only perspective, and that is a phenomenon specific to our time. As we mentioned, the speed of information accelerates the access to it and with it its quantity. This results in a multi-perspective that makes the hegemonic gaze impossible and, following Nassehi's proposal, the possibilities of uniqueness are lost. With this, the same problem can and has to be seen from different perspectives and the notions themselves, in turn, become multipurpose. From what has been observed, the plurality and lack of definition of the third and fourth industrial revolutions, and those to come, seems a necessary and insurmountable phenomenon.

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