Hyperautomation as a vital optimization tool in organizations: cognitive approach with the use of Euler circles

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Abstract

Purpose – Hyperautomation is a technological concept whose popularity has been growing continuously since the German manufacturing industry "initiated" the Fourth Industrial Revolution (Industry 4.0), whereas, on the basis of theory, hyperautomation is a term still new and little recognized. This applies equally to scientific studies (articles, conference reports) and empirical studies (quantitative, qualitative). Therefore, this article attempts to fill definition gap that exists in the literature on management and quality sciences on the term hyperautomation.

Design/methodology/approach – The authors use literature review approach to identify the gaps in the existing literature on hyperautomation. They present a nominal definition of hyperautomation, discuss related issues and provide a comparative perspective between hyperautomation and automation.

Findings – The article's findings include a precise definition of hyperautomation and the problems it raises. The authors point out that the term "hyperautomation" is still relatively new and underutilized in the management and quality sciences literature. It also compares hyperautomation to automation from several angles and emphasizes how it affects businesses, industries and other economic sectors.

Practical implications – Authors emphasize that in order to deploy hyperautomation successfully, enterprises must take a distributed and integrated approach.

Originality/value – This article addresses a gap in the management and quality sciences literature about the definition of hyperautomation. Authors give a thorough explanation of hyperautomation, along with relevant problems, useful implications and a comparison between hyperautomation versus automation.

Keywords Automation, Intelligent automation, Hyperautomation

Paper type Research paper

Introduction

The development of Industry 4.0 at the dawn of the 21st century ushered in a digital transformation of production and launched new value creation processes in organizations and supply chains on a global scale. The high rate of change, which has been maintained since the beginning of this process, has been further dynamized by the COVID-19 global pandemic, which, a few years ahead of predictions, has changed the way organizations operate in various industries, sectors and branches of the economy. This thesis also seems to

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be supported by the global research carried out in mid-2020 by McKinsey, a consultancy firm, among nearly 900 senior directors and managers. In their view, as the measurements showed, organizations have accelerated digitalization in the areas of cooperation with customers, supply chain and internal processes, by three to four years. And the mere share of digital products in their portfolio has accelerated by as much as seven years (LaBerge *et al.*, 2020). These changes, however, would not have been possible without—above all—a more sophisticated structure of automation, which on the basis of both practice and theory was assumed to be called hyperautomation (less often: intelligent automation). As a technological concept, it allows the use of advanced and innovative tools, whether in the form of artificial intelligence, machine learning or cloud computing, etc., to detect, analyze, measure, construct, monitor, anticipate and improve complex operational and business processes in the organization. As a result, its capabilities and readiness to implement and adapt state-of-the-art technological solutions are increasing, leading to an enhancement in its digital maturity, which today is considered a key determinant of success for organizations starting their digital transformation. Nevertheless, hyperautomation is a new trend and is not fully identified—especially on a theoretical basis—which determines the need for its conceptualization and, in a further step, also its operationalization.

Purpose of the article

Given the rationale referred to in the introduction, the publication's primary objective is to fill the cognitive gap that exists in the literature of economic sciences, including management and quality sciences, in the context of the concept of hyperautomation. These are deficiencies that are definitive, exploratory and comparative in nature, the attempt to make up which is always crucial for maintaining continuity and progress in learning. Therefore, the first and cardinal task set by the authors of this publication is to try to present a *nominal definition* of hyperautomation. This approach will, from the point of view of conceptualizing the subject, allow observation of the further development of hyperautomation in organizations and its proper interpretation. From a synthetic perspective, this is also intended to continuously search for and build tools to measure hyperautomation (i.e. its level or scale) in the real world.

Methodology

The research methodology adopted in this work is qualitative in nature and consists of three stages. In stage 1—from the typology of literature reviews according to the SALSA criteria (SALSA—Search, AppraisaL, Synthesis and Analysis) (Booth, Sutton, & Papaioannou, 2012)—a research method in the form of literature review was selected to analyze the results related to the concept of hyperautomation. However, due to its polymorphic nature, it has been limited to two forms: *state-of-art review* and *integrative review* (Creswell, 2014). The first focuses on presenting the current state of knowledge on the definition of hyperautomation, and the second on how the issue of hyperautomation is interpreted and perceived by other authors, researchers and experts. The subject of stage 2 is the presentation of a nominal definition of hyperautomation, the conceptualization of which takes place using direct inference and selected elements of syllogistics, in the form of Euler diagrams (Stapleton, Rodgers, Howse, & Taylor, 2007). Their use allows the identification of not all (as is the case with Venn diagrams, see Gunstone & White, 1986), but only of those important relationships between automation, hyperautomation and (hyper)connectivity. Stage 3—last—is a compilation of the concepts of automation and hyperautomation and an attempt to evaluate them using comparative analysis.

Research/results

At the outset, it should be noted that the term hyperautomation has in the literature of the subject terms which are equivalent to it in the form of *intelligent automation* or, more succinctly, *intelligent process automation* (Nunes, Leite, & Pedrosa, 2020; Bornet, Barkin, & Wirtz, 2021). This means that, on the basis of scientific publications, the concept of hyperautomation can be interchangeable with terms intelligent automation or intelligent process automation, provided that the appropriate context is retained. However, hyperautomation is a more complete concept than the two previously mentioned, and its complexity better reflects the essence of the phenomenon of "hyperautomation" or "superautomation." A literature review conducted by the authors on the number of scientific publications on hyperautomation in general, in the field of management and quality sciences (Buła & Niedzielski, 2021), revealed a significant conceptual, cognitive and research gap in this field. The same is true of the explanation of the meaning of the concept of hyperautomation, which, for the time being, has seen much more perspectives than on the basis of science. Meanwhile, in science, the conceptualization of concepts is an important part of the research process and a starting point for operationalization activities, which in the final stage are intended to lead to the construction of measurement tools intended for quantifying a given phenomenon or trend (Rao & Reddy, 2013). In order to fill this gap, Table 1 presents equivalent definitions (containing: *definiendum,* hyphen and *definiens)* of hyperautomation, which reflect the current state of understanding of this concept in scientific literature and provide the starting point for presenting the author's definition of nominal hyperautomation.

In the context of the authors' perception of hyperautomation, the analysis presented above leads to conclusions, which can be divided into two groups. The first are conclusions relating to similarities and the second to the differences within the *definiens* of hyperautomation terms presented in Table 1. To begin with, by focusing on the compatibility between the *definiens* referred to above, several issues should be noted. First, the authors point out that hyperautomation is inextricably linked to the concept of Industry 4.0, which in practice was initiated with the arrival of the First Industrial Revolution and automation. In a scientific article from March 1959 entitled "Filozofia Automacji," its author M. Garnysz wrote that as early as 1954, the then President of the American Congress of Industrial Organizations (CIO), founded in The United States (1935), Mr. Reuther states that "the revolution of automation is by no means a matter of the future, but has already happened" (Garnysz, 1959). Second, almost everyone in their definitions, at the center of this phenomenon puts the organization as the main beneficiary of intelligent automation. However, the organization itself—seemingly *per se*—should be understood much more broadly, i.e. through the prism of its processes, working people or the implementation of strategic objectives (including operational or tactical), to which it has been committed by its stakeholders. Third, it is worth noting that some *definiens* place clear emphasis on aspects related to connectivity or even hyperconnectivity (for more information on hyperconnectivity see: Carré & Vidal, 2018). This shows that hyperautomation has a direct connection with the transmission of various content, signals or images, mainly in the machine-to-machine system, but also human–machine or human–machine–organization. With this in mind, one can therefore argue that there is no hyperautomation without hyperconnectivity. It is difficult to imagine that hyperautomation could function or develop in isolation from information and communication technology (ICT) systems and applications. Fourth, an important element of all these concepts is that their creators list a number of innovative digital methods and technologies that build hyperautomation, including in particular: robotic process automation (RPA), machine learning (ML), artificial intelligence (AI) or link control protocol (LCP). Nevertheless, in the face of similarities between the hyperautomation terms, there are also some differences (see Table 2). The first is that hyperautomation is variously defined by the authors themselves, in the sense that some consider it a trend or phenomenon, others as a concept or

Definiendum	Hyphen	Definiens	Author/source
Intelligent Automation (Hyperautomation) (1)	this is	one of the most modern trends in the field of widely understood artificial intelligence. In practice, it is a novel combination of methods and technologies including: humans, organizations, machine learning (ML), low-code platforms (LCP), robotic process automation (RPA), and other tools, techniques, solutionsetc	Bornet *et al.* (2021)
Hyperautomation (2)	these are	holistic activities relating to automation throughout the organization, which is closely linked to Industry 4.0 and the digital twin concept (DT)	Jacoby and Usländer (2020)
Hyper-automation (3)	this is	a strategic initiative of the organization consisting of the continuous development of automation and improvement of business results, using a combination of technologies, the foundation of which is robotic process automation	JOLT Advantage Group (2021)
Hyperautomation (4)	this is	a technological term that involves the automation of knowledge-based work with a wide range of business and technology, integrated into a responsive workforce, mainly linking RPA with ML and/or other AI functions	Lasso-Rodriguez and Winkler (2020)
Hyper automation (5)	this is	a concept that, in the era of the Fourth Industrial Revolution, expands the range of tasks that can be subjected to automation and includes not only highly repetitive low-skilled work, but also highly routine, medium-skilled work. In practice, hyperautomation and hyperconnectivity enable the construction of intelligent enterprises supported by key technologies	Park (2018)
Hyperautomation (6)	this is	a phenomenon characteristic of the Fourth Industrial Revolution and closely related to hyperconnectivity, which contributes to the rapid development of innovation and the transformation of the competitive environment of the organization	Chih-Yia and Bou-Wenb (2021)

Source(s): Own study

Table 1.
Hyperautomation - selected equality definitions

action, and others as a form of strategy or conceptual term. However, even from an etymological point of view, words such as trend or strategy seem distant to each other or at least different. A "trend" refers to the regularity existing within a time framework which is subject to development, while a "strategy" is nothing more than clearly defined rules for the preparation and conduct of targeted activities. The second difference concerns the degree of blurring or imprecision in defining hyperautomation. As an exemplification, it is worth noting, the differences between *definiens* 1 and 6 (Tables 1 and 2). The third, last, difference is that, given the *definiens* presented in Table 1, hyperautomation definitions can be divided into both scoped and contextual ones. And, in terms of their number, the latter seem to be towering over the former. Meanwhile, Table 2 presents, in graphic form, the comparative equality definitions of hyperautomation.

In the context of the above, having knowledge of contemporary perspectives on hyperautomation, we can now proceed to try to name this term, creating its nominal

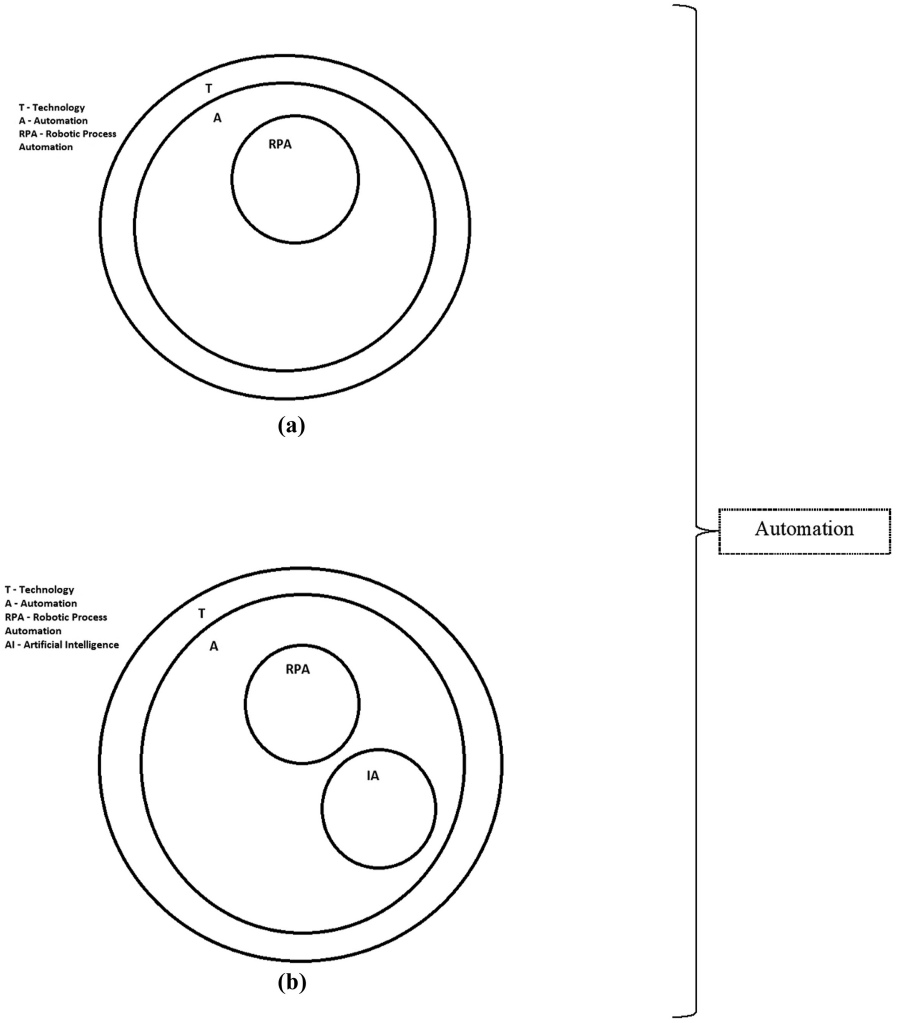
	Definiens	Definiens 1	Definiens 2	Definiens 3	Definiens 4	Definiens 5	Definiens 6
Attribute							
Refers to the concept of Industry 4.0		*no*	yes	no	no	yes	yes
Refers to the phenomenon of automation		*no*	yes	yes	no	yes	no
Refers to digital tools, e.g. RPA, ML, AI, OCR etc		*yes*	no	yes	yes	no	no
Uses the word connectivity, connection, hyperconnectivity		*yes*	no	no	yes	yes	yes
Presents convergent expressions (synonyms) to hyperautomation		*yes*	no	no	no	no	no
Refers to the organization		*yes*	*yes*	*yes*	*no*	*yes*	*yes*
Refers to people		*yes*	no	no	yes	no	no
Refers to machines		*no*	no	no	no	no	no
Refers to processes		*no*	no	yes	no	no	no

Source(s): Own study

Table 2.
Hyperautomation equality definitions—comparative approach

definition, the design of which will be based on Euler's diagrams. To begin with, however, it should be emphasized that the nominal definition of hyperautomation presented in this article will result from the analysis and interpretation of the materials which, in tabular form, have been presented in Tables 1 and 2 and from previous literature reviews (Buła & Niedzielski, 2021). Moreover, its content will take into account both linguistic and logical correctness, which in science is decisive for formulating final conclusions from undertaken research. Moreover, perhaps most importantly, the nominal definition of hyperautomation presented must answer the first and simultaneously last question, one cardinal in nature, namely: *what does it mean and what is contained within hyperautomation?* When answering, three points should be highlighted at the outset. First, it should be made clear that the development of technologies, including so-called modern technologies, is crucial for preserving progress. In other words, there is no progress without technology, just as there is no technology, without scientific knowledge and discovery. They, at the threshold of the First Industrial Revolution, gave rise not only to new solutions, techniques or patents but also to the revolution related to automation. It is automation as a technology, which has started—and continues today—the process of minimizing human contribution to manufacturing or production activities. One of its "products" is technology in the form of RPA, which technicizes work in the field of repeatable business processes, transferring the burden of its execution entirely on robots that simulate human labor. This statement in graphic terms is presented in Figure 1(a) and proves that robotic automation of processes on the basis of subordination relations is a solution that is part of the widely understood automation, which began with the development of the first technologies in the form of: energization, mechanization, automation or—going further—computerization. Second, as is presented in Figure 1(b) graphically, in addition to RPA technology, we have others, even in the form of AI, which complement each other. In practice, their technological coexistence enables the automation of business processes, thus improving their operational efficiency. However, what should be emphasized here is the lack of connectivity or common predefined rules for processes carried out in the tandem of RPA and AI means that separated tools remain in the circle of automation but cannot be directly equated with the concept of hyperautomation. This means that the mere fact that an organization possesses solutions in the form of RPA or AI (or similar) does not yet indicate hyperautomation but only automation (Figure 1(b)). The issue is that the *sine qua non* condition of the organization's implementation of the concept of hyperautomation is that two or more modern digital technologies are interconnected, have common elements and there will be interaction between them (see: Figure 1(a)). And third, taking into account the outline by the combined tools within the concept of Euler diagrams of a common core (Figure 2(b)), it should be noted that it is the epicenter of certain elements of all (in the sense of those mentioned here) digital technologies emerging from hyperautomation. In other words, the sum of the partial coincidental actions that has been created by different types of digital technologies belonging to the common circle of automation defines graphically (see: Figure 2(b)) the essence of hyperautomation. This means that hyperautomation as a concept starts with technology, which is entirely subordinated to the issue of automation (Figure 1(a)), which, on the basis of equivalence relations, coincides with the concepts of RPA, AI, low-code development platform (LCPD), virtual assistant (VA), intelligent business process management system (IBPMS), optical character recognition (OCR), and those, as a result of partial coincidence (intersection) and entry of each of them into a different range, form a sum (common field), which we define as intelligent automation (hyperautomation) (Figure 2(b)).

Given the above, we can now progress to presenting a nominal definition of hyperautomation. As it will be design-regulatory in nature, the words contained in it will be given a new meaning and the definition itself will be precise. Thus, when offering the meaning of the term "hyperautomation," it should be said that: "hyperautomation is a technological concept connected to Industry 4.0, relating to activities undertaken in the



Source(s): Own study

Figure 1.
Definition of automation—graphic approach using Euler diagrams (a) example I (b) example II

organization for the development of automation and the improvement of business and technological processes, implemented with the help of a minimum of two integrated digital technologies on the principle of partial coincidence, enabling a construction of the push-button organization" (push-button organizations are organizations that would be started by pressing a button, after which they would perform by themselves all the actions, tasks, processes, etc.). At the same time, it should be added that, taking into account the systemic criterion, hyperautomation can be divided into distributed and integrated. As for the first one, we will consider as "distributed hyperautomation in the organization, a system of loosely coupled digital technologies, such as: RPA, AI, LCPD, VA, IBPMS, OCR, etc., which are connected to each other on the principle of partial coincidence" (Figure 3). On the other hand, we will consider *as integrated hyperautomation in the organization, a system of densely coupled*

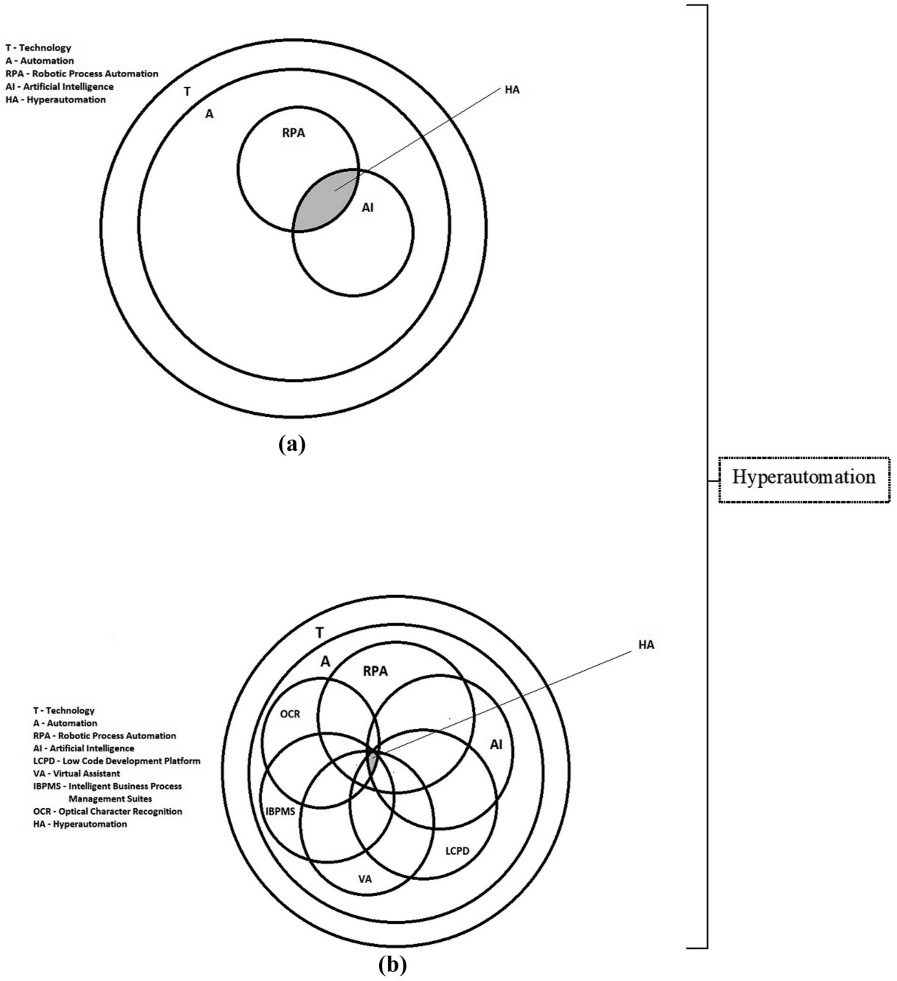
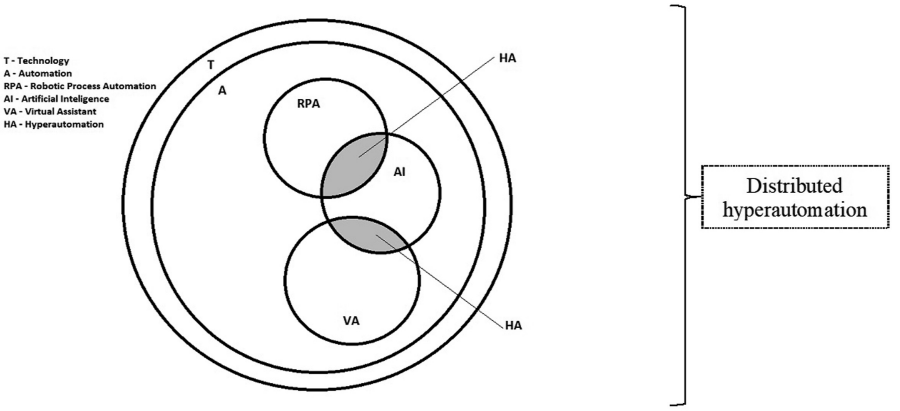


Figure 2.
Definition of hyperautomation—graphic approach using Euler diagrams (a) example I (b) example II

Source(s): Own study

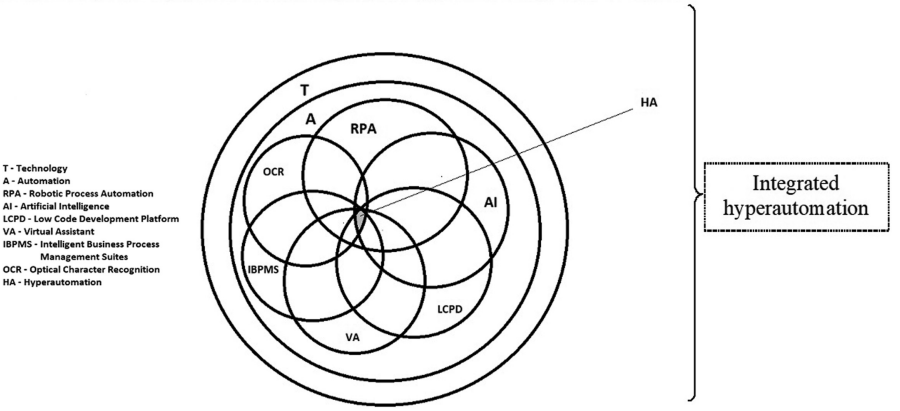
digital technologies, such as: RPA, AI, LCPD, VA, IBPMS, OCR, etc., which are interconnected on the principle of partial coincidence (Figure 4). In both cases, the interconnected digital technology systems are organized in a component-based manner and can support all or only selected areas of the organization's management.

Against the background of the nominal definition of hyperautomation presented above, a question arises as to the existence of differences between it and the concept of automation. Especially since, initially, the two terms sound almost identical from the point of view of articulation phonetics, and what distinguishes them is only the prefix "hyper." Nevertheless, the distinctness between hyperautomation and automation is much greater and varied and centers on their different attributes or areas. Seven key differences are defined. First, it should be noted that hyperautomation is a new technological trend, inextricably linked to Industry 4.0, while hyperautomation is a concept that, in the context of replacing human muscle work



Source(s): Own study

Figure 3.
Distributed hyperautomation—graphic approach using Euler diagrams



Source(s): Own study

Figure 4.
Integrated hyperautomation—graphic approach using Euler diagrams

with the energy supplied by machines (Malewski, 1958), has evolved since the birth of the First Industrial Revolution, that is, from the second half of the 18th century. Second, from an etymological point of view, the first part of the complex expression "hyperautomation" shows that, unlike automation, it is characterized by an excess of automation, i.e. the occurrence of its much greater intensity in the organization. In practice, simple automation of tasks and processes in the enterprise, transforms towards high-tech tools (such as: AI, ML, NLP, etc.), which, networked using the Internet, form an intelligent organization. Thirdly, in view of what has been said above, the development of hyperautomation would not have been possible without a network, namely the internet. The heyday of its fifth generation (5G)—and in the near future also the sixth (6G)—makes wireless communication technology able to more precisely create virtual reality or smart cities and organizations. Fourth, hyperautomation—as opposed to automation—can seriously support decision-making processes in the organization, especially those undertaken in conditions of uncertainty, complex problems or risk (Phillips-Wren, 2012; Trunk, Birkel, & Hartmann, 2020). Fifth, from the point of view of

freedom and scope of action, all—even the most complex—organizational and business processes can be subjected to hyperautomation, while only those whose data are structured can be automated. However, accuracy, completeness, consistency, reliability and timeliness of data will always be crucial for the organization and its processes, as low-quality data lead to inaccurate analyses, followed by erroneous operational and strategic decisions. Sixth, although technologies connected to hyperautomation contribute to, e.g., reducing the cost of the organization's fixed costs, enhancing and raising the quality of processes, reducing anomalies and risks or increasing productivity, in practice their development is highly capital intensive (even several times more when compared to automation). A significant part of the costs are mainly generated by: number of functions, manpower resources (man-hours), developer salaries, IT infrastructure, software, administration and organization of work, projects, tests, implementations and servicing related to updating and maintenance of technology. And seventh, the last material effect of the development of hyperautomation in the organization is to build a smart enterprise, of the push-button type. The comparative view of hyperautomation and automation presented above (which is presented in the graphical version in Table 3, below) does not exhaust the wide range of differences but also the similarities between the two concepts. On the contrary, it is intended to encourage other researchers to engage in further, in-depth analyses of their substance, which—according to the authors—will allow researchers to better understand the possibilities, potential and direction of development, especially the idea of hyperautomation in the world of enterprises.

Table 3.
Automation vs. hyperautomation—a comparative perspective

	Automation	Hyperautomation
Etymology	from English: *automation*	from English: *hyperautomation* or *hyper-automation*
Place of origin	United States of America	United States of America
Time of inception	2nd half of 18th century	1st half of 21st century
Concept type	Old	New
Industry concept	Industry 1.0	Industry 4.0
Development thanks to	Mechanization	Internet
Trend type	Evolutionary	Revolutionary
Technology	Robotic automation of tasks and processes	Ecosystem of high-tech tools and links (sensors, etc.)
Type of technology	Simple	Complex and highly complex
Tools	RPA	AI, ML, NLP, OCR, chatbots
Results of the action	Efficient operations and processes	Efficient and intelligent operations, processes, systems
Automation range	Simple tasks and processes	Everything that is possible (no formal restrictions)
Area	Carried out mostly using a single platform	Most frequently carried out using an ecosystem of platforms, systems, technologies and tools
Constraints	Structured data	No restrictions
Management	Does not participate in the decision-making process	Supports decision-making
Effects	Automation	Hyperautomation, megaautomation
Characteristic of	Automated organizations	Digital organizations and push-button organizations
Costs	Small/medium	High
Human resources	Bypasses/eliminates	Engages
Benefits	Fast RETURN on investment and increased productivity	Integration of digital technologies and the ability of employees to focus - thanks to more time - on tasks with greater added value for the organization

Source(s): Own study

Discussion/conclusions

This article, devoted entirely to the issue of intelligent self-automation, presents a nominal definition of hyperautomation, which was developed mainly through a research methodology based on Euler diagrams (Figures 1(a, b) and 2(a)). As a result of the defining process, the *definiens* was specified for the hyperautomation expression, which takes into account the unification rule and the principle of partial coincidence, so important for Euler's inference scheme (Figure 2(b)). The research instrument used in the form of Euler diagrams, literature review or integrative review—including a comparative view of the equal definition of hyperautomation (Table 1)—has created a much broader research perspective that has contributed to the development of *definiens,* also for the terms "distributed hyperautomation" (Figure 3) and "integrated hyperautomation" (Figure 4). Consequently, this contributed to a more precise definition of the basic term, which was the subject of this article, namely "hyperautomation." However, given the consideration presented in this work, both theoretical and practical terms, of various types of: properties, characteristics, equivalences, partial adjustments, theories or also facts about hyperautomation (but also automation) that have been examined, we can undertake to formulate several original and reasonable conclusions and diagnoses of an explication and/or discriminatory and evaluatory nature. First, it should be noted that the term "hyperautomation," as evidenced by literature studies conducted by Buła and Niedzielski (2021), is a phrase still new and little recognized, especially on the basis of theory. According to Google Trends analysis, the popularity of the term hyperautomation in the Internet began to grow from July 1, 2019 (for more information see: https://trends.google.com). Second, hyperautomation is a technological concept created as a result of the development of Industry 4.0 and represents a hyperdimensional level of automation, which started with the development of Industry 1.0. Third, the nominal definition of design and regulatory hyperautomation presented in this work attempts to fill the conceptual gap in the literature on management and quality sciences. Fourth, conceptualizing the term hyperautomation, but also, taking into account the systemic criterion, distributed and integrated hyperautomation, is an important starting point for operationalization activities, which in the final stages are intended to lead to the construction of measurement tools for quantitative hyperautomation in relation to the sciences of organization and management. Fifth, in the absence of scientific studies on the concept of hyperautomation, scientific value and usability will be reduced not only of itself but also indirectly of the management and quality sciences. Sixth, the comparative approach between automation and hyperautomation shows that, despite the similarity resulting from the articulation phonetics between these concepts, they are concepts that show differences in many fields. Seventh, it should be made clear that the main determinants of the development of hyperautomation are the internet and the fifth and subsequent generations of mobile networks. But it should also be noted that at the same time these technologies set the limits for its possible progress. Eighth, the final result of the development of hyperautomation in the organization is to build an intelligent enterprise, of the push-button type. And lastly, it should be assumed that hyperautomation will become the most important source of competitive advantage of the organization in the first half of the 21st century.

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