

Industry 4.0 and frame accounting: a modern uprising?

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Abstract: This study was conducted because the current situation requires awareness, assumption and rapid action in a context where digitalization has changed the business world more than anyone expected, putting pressure on the employed human capital, which now requires continuous professional development. We believe it's time to learn to reinvent ourselves and progress every day to keep up with the changing environment. Industry 4.0, suggestively called "Web of Things", originated in Germany and emerged to make people's work easier by automating repetitive processes and more. Thus, many companies have begun to turn to artificial intelligence (IoT) to solve work tasks. In terms of accounting, the accounting profession will transform considerably by 2025 as public expectations have evolved. We will see how the ability to integrate artificial intelligence and use Big Data will help accountants use the data produced by the system and generate important insights into decision [10] [1]. However, implementing these technological innovations will not entirely eliminate the role of accountants. The study also draws attention to the impact of the digital age on the environment, on the use of renewable energy. The study below contributes to the literature by presenting the impact of digital technology, as Romanian businesses need to be very diligent in terms of having the necessary skills to take advantage of the latest developments in information technology to maintain their position in the market.

Keywords: *Industry 4.0; Artificial intelligence; Accounting; Medium; Software*

Introduction

The term Industry 4.0 is currently on everyone's lips. The term is used almost inflationarily in publications, at specialized conferences and at fairs. But what's behind the Industry 4.0 keyword?

The term was first widely used at the Hannover Fair in April 2011. There, the communication promoter group of the Business-Science Research Union presented their idea of the industry of the future. From 2006 to 2013, the Research Union supported the implementation and further development of the federal government's high-tech strategy as the central advisory body for innovation policy. The research union was made up of 28 high-ranking representatives of business and science.

In November 2011, the federal government adopted the future Industry 4.0 project in its high-tech strategy action plan.

The term Industry 4.0 represents the fourth industrial revolution, a new level of organization and control of the entire value chain throughout the product lifecycle. This cycle is based on increased individualized customer requirements that relate to ordering, development and production, delivery of a product to the end customer until recycling, including associated services.

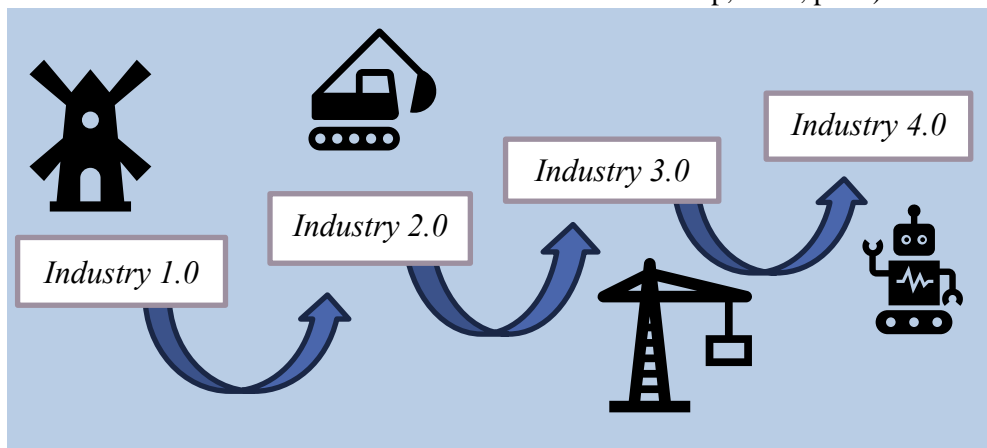
Thus, we ask ourselves: how can companies best adapt and benefit from the transformations induced by Industry 4.0 in their value chain? It is certain that the implementation of Industry 4.0 has an impact on the entire value chain. Smart networking leads to better integration of all actors involved. Industry 4.0 essentially involves the development and integration of innovative information and communication technologies into industrial applications.

As can be seen from Fig.1, the starting point of the first industrial revolution was the development of the steam engine and the automation of repetitive work by robots.

As for the second stage of the transformation, it focused on the exploitation of electricity, which allowed the introduction of the assembly line. The third industrial revolution is the automation of production processes through the increasing use of electronic, information, communication technologies. [2]

The characteristic of the fourth industrial revolution is the creation of smart grids based on cyber-physical systems, robots (see Figure 1).

Figure. 1. The Four Stages of Industrial Revolutions (Report of the Research Union for Economics and Science Communication Promoters' Group, 2012, p. 13)



Source: Own source

Thus, the fourth stage of the revolution was the automation of processes from production to accounting. Market disintegration has therefore been achieved through the physical disconnection of supply and demand, which will only take place online. Concluding, the workforce is undergoing a process of radical transformation, which makes us wonder: how will human capital survive in the face of artificial intelligence, what are the main challenges and opportunities for the workforce in the context of adopting Industry 4.0 technologies? [3]

In the economic context, Industry 4.0 is described as having a positive impact on labor productivity and resource efficiency, while digitalization of accounting is presented as a necessity to effectively manage financial operations. The integration of SAP systems in the business environment is mentioned as a relevant example in this regard. [5]

In order to enhance the identified positive impact, companies need support from the State in which they do business. Therefore, through this paper we aim to answer the question: how can government policy and regulations facilitate the transition to Industry 4.0 and maximize the economic, social and environmental benefits of this transformation?

This article analyses the concept of Industry 4.0, highlighting its impact on the economy, environment and society. The authors underline that Industry 4.0 represents a new stage in the industrial revolution, characterized by the integration of information and communication technologies into industrial applications. Key talking points include Industry 4.0 value chain transformations, economic and environmental benefits, challenges and opportunities for the workforce, and support through government policy and regulations.

Literature Review

The literature highlights the importance of Industry 4.0 in transforming the field of accounting. Recent studies explore how digital and innovative technologies such as the Internet of Things (IoT), artificial intelligence (AI), and data analytics affect accounting practices and financial reporting processes. It also examines the impact of these technologies on operational efficiency and decision-making in organizations.

In reviewing literature, it is essential to mention studies that include financial metrics to illustrate the economic impact of Industry 4.0. Below are some examples of such studies:

Study by Kiel et al. (2017): This study examines the economic impact of Industry 4.0, highlighting increased labor productivity and improvements in operational efficiency in companies. By assessing financial metrics, the authors demonstrate how the adoption of Industry 4.0 technologies can lead to increased profitability and financial performance of enterprises.

The work of Costa, F. and Portioli-Staudacher, A. (2021) : This paper examines how Industry 4.0 affects the future of work and human resource management. The authors analyze changes in employee roles and responsibilities, as well as their impact on organizations' financial performance. By including financial data in their analysis, they provide comprehensive insight into the economic implications of the transition to Industry 4.0.

Stryzhak's study (2023): This study focuses on the impact of Industry 4.0 on the labour market and highlights changes in the employment structure and demand for skills and abilities. The author also examines the effects of these changes on the financial performance of organizations, providing relevant data and statistics to emphasize the importance of adapting to new labor market requirements.

These studies provide detailed insight into how Industry 4.0 affects the financial aspects of business and demonstrate the importance of valuing financial values in understanding the economic impact of this industrial revolution.

Thus, the literature review highlights that Industry 4.0 represents a radical transformation in the way society and economy function and interact. The authors stress the need for an integrated and sustainable approach to this industrial revolution and suggest that increased attention to continuous training of the workforce and adaptability to technological change is crucial to success in the Industry 4.0 era. They also stress the importance of future research in Industry 4.0, with a focus on developing innovative solutions and sustainable implementation strategies. [6]

Economic side

Our evolution and that of the society we live in has taken place primarily to solve the economic problems we face daily, but this must be harnessed carefully, because there is now another challenge: once artificial intelligence frees us from pressing economic concerns, we need to use our leisure time productively. [9]

Artificial intelligence has the potential to greatly improve our daily lives, benefiting the economy, healthcare, public administration, human transport, as well as information, sustainable agriculture and the environment. AI can provide an accurate and immediate diagnosis, replace humans in performing repetitive, dangerous tasks, generating free time in which human capital has the opportunity to exploit its creative side. [8]

Europe's competitiveness and productivity are closely linked to its ability to efficiently exploit digital innovations across all sectors of the economy, arguing that digitalisation must be one of its top priorities. [19]

In the smart factory with flexible, decentrally controlled and networked production facilities, resources can be used much more efficiently and productively.

This means that individualised products made to customer specifications can be manufactured cost-effectively and produced flexibly [17]

Data that is evaluated using intelligent algorithms (intelligent data) helps to make forecasts more accurate and earlier.

This makes the company much more resilient to market fluctuations, global economic crises and

disruptions. With the spread of the internet, the concept of value chain is transforming into an ad hoc decentralised value network. [17]

In addition, interfaces between and within systems and the Internet of Things expand the spectrum of service-oriented business models.

Today, thanks to digitalization, which is gaining more and more courage, companies can be protagonists of the future, overcoming the economic crisis, strengthened by the Covid-19 pandemic.

Industry 4.0 benefits economically, as it increases labour productivity, and in terms of (environmental) impact, as it leads to a much more efficient use of available resources; Also, the social side is not to be neglected, digitalization increasing the competitiveness of employees and, implicitly, their interest in increasing the added value they can bring to the employing company [7]

Ecological impact

Particular attention should be paid to sustainability, which can reshape the architecture of companies, creating new prototypes such as technology, focusing on eliminating pollution, lowering carbon emissions, increasing energy efficiency, recycling materials, etc. [21]

Many developments, including increasing digitalisation and networking, Information and Communication Technology (ICT) are leading to a reduction in energy and resource consumption.

In the smart factory, sensor-based system solutions measure this actual energy and resource consumption. With this partly real, partly virtual data, which is transferred directly to the ERP system, for example, complete transparency can be achieved.

The production process in terms of energy and resource consumption can be created. If this is too high in an area, decisions can be optimized in steps to help in real time.

At the same time, transport routes and use can be planned more efficiently in logistics. It also offers great potential for intralogistics optimisation.

Material handling and material flows in the internal area can be made more flexible and faster through intelligent transport systems.

Taking into account energy consumption, resource use and raw material productivity dressed by Industry 4.0, significant contributions to environmental and economic sustainability are observed. [17]

We are at a point where we need to pay more attention to the green economy, as it generates economic growth, creates jobs and reduces poverty through investments that protect the natural capital resources on which the survival of our planet depends, as well as the well-being and health of the population as a whole.

Industry 4.0 – Revolution or not?

Currently, there is still confusion about a uniform definition of the term and how businesses, society and the economy should cope with the lack of one.

The debate also continues to arise as to whether Industry 4.0 is a revolution or just the continuation of an evolutionary development. However, there are also experts who attest that the fourth industrial revolution is revolutionary in nature.

Author Klaus Schwab tries in his book "The Fourth Industrial Revolution" to explain why this current uses three-factor developments around the Internet of Things or artificial intelligence and is not part of the third industrial revolution. [15] In his opinion, the speed with which current changes play a key role was initiated in the fourth industrial revolution. This speed, favored by the digitized world, is no longer linear, as in the previous three revolutions, but exponential. The author also believes that the digital revolution will trigger a paradigm shift for society and the economy.

The third argument he brings is that these transformations affect entire systems, whether at the level of country, industry or company [15]

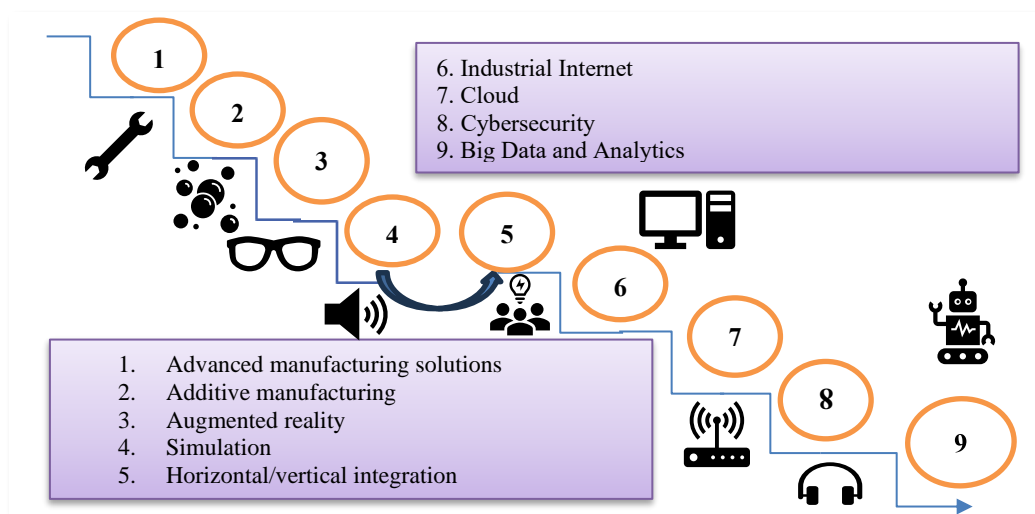
Industry 4.0 is truly revolutionary in the context in which employees reach the performance of improving human intelligence with the help of artificial intelligence, having the ability to cope with constant transformations and rapid changes.

But to do this, employees must show a high degree of flexibility; must be able to perform several tasks simultaneously by dividing responsibilities, so they must have broad general knowledge and specific skills. [5]

All this leads to the simple conclusion that, in terms of the labor market, Industry 4.0 is certainly revolutionary, as it will lead to the disappearance of certain professions, now replaced by artificial intelligence, robots, software, and the emergence of new occupations, which will force employees to retrain to earn a living [18]

Figure 2 below illustrates the many technological improvements brought about by Industry 4.0, but in fact, for an entity to be considered 4.0, it is not enough just to purchase innovative machines or systems, but it is also necessary for human capital to have specific skills to use technological tools in a compliant manner and to their full potential.

Figure 2. Industry 4.0 – Technology skills



Source: Own source

Digitalisation and its reflection on accounting

Digitization in companies is not a trend of our time, since the use of computer technology and software, especially in industrial manufacturing companies, has long developed.

ERP systems are responsible for production planning. Detailed planning and optimization that takes into account the capacity and availability of materials is carried out by systems such as MRP, APS, PPS, etc.

Automation has also made it possible to use on demand synchronous acquisition methods, such as just-in-time or just-in-sequence to be established, to reduce batch sizes and storage capacities. In the event of a production failure, all these IT solutions have one common weakness. Although you'll get the usual feedback from production machines, you can't autonomously reprogram and realign production. Here people have to intervene manually. [17]

This is exactly where Industry 4.0 comes in and goes one step further. Digitalisation here means that all signals and information in the production system are digitally available and can be used. This does not only include equipping production systems with sensors and actuators. Information about the production process is also included.

The main goal is to achieve "a meaningful process and "continuously record state variables and make them transparent." [15]

As already described above, vertical integration of systems is prerequisite to ensure a uniform and compatible IT landscape.

The horizontal integration of CPS enables the exchange of information beyond company borders.

This fusion of the real and virtual world and the extensive exchange of real-time information opens up new perspectives in optimizing logistics and decision-making. [4]

Ram Jambunathan, who holds the CEO role at SAP, says we have finally reached the point where companies have come to terms with the consequences of implementing Industry 4.0 and realized the

multiple benefits of using digital technology in their work processes. [15]

The most important step in achieving your goals, with minimal effort and maximum efficiency, is understanding the steps that need to be taken to reap the full benefits of the fourth industrial revolution. This puts companies in a position to carefully analyze situations that arise in practice and make a long-term plan.

From an economic point of view, cash flow must be carefully managed, and for the best decisions to be made, management must have complete control over all financial operations, over all movements in accounts. [14] For these reasons, many companies have turned to implementing SAP Business One software, which aims to collect and manage all accounting data involved, automate repetitive processes that can lead to mistakes inherent in human fatigue, holding multiple functions, including: banking, financial reporting, reconciliations, etc. SAP is a software that has proven its professionalism over time, but as criticisms made by users, we noted the somewhat cumbersome interface, which requires employers to train staff through licensed consultants.

So what is SAP? SAP is one of the world's leading manufacturers of business process management software.

Of course, the effort of companies that have recognized Industry 4.0 as a strategic priority, without which they cannot thrive, should be appreciated. According to studies, the results of the impact of the digital age are visible, with more than half of the manufacturing companies surveyed stating that the artificial intelligence they have integrated into their business has increased their profitability by over 5% this year compared to the previous year. Following the digitalization of accounting, companies have shown greater interest in SAP software to adapt to the transformation of the accounting profession. In the knowledge economy, intellectual property becomes essential. There are firms whose value is derived from ideas and applications rather than traditional commodity-producing assets, resulting in a huge gap between the firm's market value and its tangible net assets. Today, scientific and accounting standards provide little information about the intellectual assets of enterprises and their sustainability.

SAP also offers a number of benefits in accounting mode for both employer and employee. The document flow is recorded in various transactions, which means that it is easier for an accountant to check the Sales Journal, the Purchase Journal. Each company can customize its VAT rates, new general ledger, asset accounting, tax, cost center, accounting, internal orders, project cost, results analysis, revenue recognition and profitability analysis according to its activity. SAP also assists the business in maintaining strong links between all departments, including modules.

For example, we have an invoice for security services, it is recorded in transaction FB60, with the VAT rate (which we see on the invoice), 19% - but here SAP offers the possibility to see this rate on a letter-by-letter basis (AD = 19% - used only for invoices), which means that it makes it easier for the accounting user not to mix VAT rates and not to use another VAT rate (see Figure 3).

Figure 3. Model for book invoice in SAP

<p style="text-align: center;">INVOICE CARD TRANSACTION USED FB60</p> <p>AMOUNT EXCL. VAT 1620 VAT 380 (AD 19%) TOTAL AMOUNT: 2000 CURRENCY: RON</p>
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Source: Own source

Benefits of using SAP software in Industry 4.0 environment:

- SAP aims to automate the production process at factory level so that the results obtained by the company are available in real time, at any time, to make the best decisions. This software has the ability to horizontally connect all processes carried out at entity level, optimizing the quality and productivity of work activities, which interconnected lead to unexpectedly good results.

- SAP helps you transform raw data into improved business process automation and actionable intelligence. The advantage lies in the ability to deeply incorporate the wealth of contextualized machine, sensor and device data (IoT data) into business processes along the value chain, leveraging artificial intelligence by significantly improving productivity and agility in industrial environments.
- SAP helps you standardize your business processes. Imagine being able to run a single, standardized business process covering all available resources globally, eliminating non-value-added operations. This means you can flexibly move production between different locations. With robust cloud solutions, SAP helps you extend Industry 4.0 to global operations and overcome factory-specific bottlenecks. The vibrant ecosystem that helps Industry 4.0 partners and institutions led by SAP; Provide the holistic support you need.
- SAP offers a broad portfolio of Industry 4.0 solutions, combining SAP solutions for design, production, logistics and operations into a single offering. This allows real-time management of business resources and making the right business decisions at the right time.

But SAP is just one of the software programs that make our lives easier and save us precious time, our most limited resource. There is a wide range of such programs on the market, and each company is free to choose the one it considers most suitable for the specifics of its business and the goals it aims to achieve. [13]

In order to assess the impact of Industry 4.0 in the field of accounting and to monitor the progress in adopting digital technologies and transforming accounting processes, we find the following indicators relevant:

Table. 1. Industry 4.0 impact assessment indicators in the field of accounting

Indicators	Contribution
Operational efficiency	Reducing the processing time of financial data and accounting reports. Increase productivity by automating repetitive accounting processes. Optimizing workflows by integrating digital technologies.
Quality of financial data	Reducing human errors in the financial recording and reporting process. Ensuring the accuracy and integrity of financial data through the use of security and cryptography technologies.
Automation of accounting processes	The percentage of automated or semi-automated accounting processes in the organization. Time and resources saved by implementing automation in accounting processes, such as account reconciliation or invoice management.
Adoption of digital technologies	The degree of use of technologies such as cloud computing, data analytics, artificial intelligence and blockchain in accounting. Investing in modern accounting software solutions and updating IT infrastructure to support digital transformation.
Flexibility and scalability	The ability of the accounting system to adapt quickly to changes in the business environment and legislative requirements. The degree of scalability of infrastructure and accounting solutions to manage data growth and complexity of operations.
Cost reduction and increased efficiency	Assessment of cost savings from process automation and optimization of accounting operations. Increase operational efficiency by reducing redundancy and downtime.

Improved transparency and reporting

The degree of transparency in financial reporting and access to real-time information for decision-makers.

Improving the quality of financial reporting and stakeholder communication thanks to the use of digital technologies.

Source: Own source

Over the past five years, the adoption rate of automated accounting software has increased by more than 30%, according to data from the National Institute of Economic Statistics. This significant increase indicates a clear trend towards the use of advanced technologies in managing financial processes.

As companies move to automated accounting solutions, operational efficiency has increased significantly. Recent studies show that the time required to complete accounting tasks has reduced by about 40% and the number of errors recorded has decreased by over 50%, according to reports published by the Association of Professional Accountants.

In parallel, the increase in the productivity of accounting staff is obvious. Internal data from large companies in the financial sector shows that the number of transactions processed by each member of the accounting team has increased by approximately 25% in the last three years.

Also, a noticeable change is observed in the requirements for employment in accounting. According to data released by the Bureau of Labor Statistics, the requirements for accountant positions have undergone significant changes, with an emphasis on knowledge of data analysis and experience in using advanced accounting software.

In conclusion, the real data highlights a significant impact of Industry 4.0 on the accounting field, with a significant increase in operational efficiency, staff productivity and changes in hiring requirements. [17]

Conclusions

Thus, from what we analyzed, we can conclude that digitalization will not only create a new world of work, but will also accelerate structural changes. Companies received the title of smart factories due to the integration of the industrial revolution analyzed above.

It is easy to see how the digital age has led to a decline in the importance of manufacturing and therefore in the number of employees, despite having a high share of value added in gross domestic product, while the information, communication and education sectors are developing favourably. [20]

However, the technological improvements brought about by the fourth industrial revolution are not enough for a company to be considered 4.0. In fact, it is a much more complex and lengthy process, primarily involving the human capital surrounding machines, software and innovations.

This stage of transformation of people's daily life and business life seems difficult because of its size, given that in our country we find a multitude of small and medium-sized enterprises, but continuous staff training will help us easily overcome all obstacles that we encounter at every step and will support us in the process of increasing performance at work.

Industry 4.0 seems to be not only a technological revolution, but also a fundamental change in the way we relate to the world around us. This transformation is likely to completely redefine the way we work, interact and live.

With the rapid advancement of technology and the ever-deeper integration of digital systems into all aspects of our lives, it is tempting to wonder if we will reach a point where humans will be completely replaced by machines and algorithms.[15]

As technology advances, the need for traditional human skills, such as those required in accounting, may decrease in favor of digital and technological skills. This change could have significant consequences for the labour market and how we prepare for the jobs of the future.

While Industry 4.0 promises unprecedented efficiency and innovation, there are also concerns about the loss of human control and the impact on our personal and social lives. It is important to pay

attention to these issues and look for ways to ensure that technological progress serves the common good and not just economic interests.

Following the research, we can say that in times of globalization, economic pressure on individual companies is increasing, which is why the three factors: cost, time and quality in the production process are crucial for economic success. More specifically, we are talking about overcoming the increasing complexity in production and logistics, individualizing products and making production more flexible. [21]

The study concludes that companies that recognize these changing conditions early on and develop strategic solutions will be able to succeed in the marketplace.[19]

In the future, we will be physically flooded with data thanks to the network of a large number of gadgets. The solution to this problem is often expressed in terms of "big data." The term "Big Data" is repeatedly used to solve the problem. [20]

The problems mentioned in this paper, and not only, confirm that digital transformation is a prerequisite for the economic recovery of our country. Therefore, Industry 4.0 must be an integral part of corporate culture and determine strategic choices within the organization and in its relations with the outside world.

Therefore, we believe that Industry 4.0 has the potential to bring both huge benefits and significant challenges to our society, such as data security, the need for staff retraining and adaptation to changes in accounting regulations. It is essential to be open to change, be prepared to adapt and find ways to manage these transformations to ensure a sustainable and equitable future for all, maximise long-term benefits and minimise potential risks. [16]

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