

**ORIGINAL**  
**Research article**

## **The opportunity to develop operational designs in the company\***

### **La oportunidad de desarrollar diseños operativos en la empresa**

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Mario Gabriel Sarián-González\*\*

ORCID: <https://orcid.org/0000-0003-2271-0532>

Darwin Alexander Martínez-Nieto\*\*\*

ORCID: <https://orcid.org/0009-0001-3786-3390>

Ysrael Alberto Martínez-Contreras\*\*\*\*

ORCID: <https://orcid.org/0000-0003-0865-057X>

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#### **Summary**

The purpose of this paper is to reflect on the opportunities of operational designs in the company. From the methodology of documentary analysis, qualitative and descriptive approach, its applications in business organizations of global impact are emphasized. Among the main results, we evaluate the validity of Amazon and Exscientia in the use of operational designs in the face of the crisis generated by the COVID 19 pandemic through the use of technology in their market operations, in contrast, small companies were affected in their cost-benefit in the same period. We conclude by highlighting the benefits of operational designs in business organizational contexts for the benefit of knowledge management, which can be extrapolated to other organizational contexts.

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\*\* Computer Science and Management Engineer by the Universidad Diego Portales, Chile. PhD in Administration by the Universidad Central, Chile. Master of Business Administration by the University of Seville, Spain. Master in Business Administration and Management with specialisation in Strategic Communication by the Pompeu Fabra University, Spain. Professor at the Universidad Autónoma de Chile. Email: [mario.sarian@uautonoma.cl](mailto:mario.sarian@uautonoma.cl)

\*\*\* Bachelor in Business Administration by the Universidad de Los Andes, Venezuela. Master in Business Management with mention in Finance by the Universidad Nacional Experimental del Táchira, Venezuela. Doctor in Education by the Universidad Pedagógica Experimental Libertador, Venezuela. Email: [darwin.martinez@uautonoma.cl](mailto:darwin.martinez@uautonoma.cl)

\*\*\*\* Doctorate in Education by the Universidad Nacional Mayor de San Marcos, Peru. Technology Manager by the British Council, UK. Specialist in the Methodological Guide Tangüis 2.0 Proposal of contracts and clauses on intellectual property and licensing for use in the link between academia and industry in Peru by the Universidad Nacional Mayor de San Marcos, Peru. Professor at the Universidad Autónoma del Perú. Email: [ymartinezc@autonoma.edu.pe](mailto:ymartinezc@autonoma.edu.pe)

**Keywords:** Crisis, Knowledge Management, Pandemic, Work, Company

### **Resumen**

El propósito del trabajo es reflexionar sobre las oportunidades de los diseños operativos en la industria - 4.0 desde el uso de la tecnología en el sector empresarial. Desde la metodología del análisis documental, enfoque cualitativo y descriptivo se enfatiza sus aplicaciones en organizaciones empresariales de impacto global. Entre los principales resultados, se evalúa la vigencia de Amazon y Exscientia en uso diseños operativo ante la crisis generada por la pandemia de COVID 19 mediante el uso de tecnología en sus operaciones del mercado en contraparte las empresas pequeñas estuvieron afectadas en su costo beneficio en el mismo periodo. Se concluye en resaltar los beneficios de los diseños operativos en contextos organizacionales empresariales en beneficio de la gestión del conocimiento el cual se puede extrapolar a otros contextos organizacionales.

**Palabras Clave:** Crisis, Gestión del Conocimiento, Pandemia, Trabajo, Empresa

### **SUMMARY**

INTRODUCTION. - RESOLUTION SCHEME. - I. Research problem. - II. Methodology. -III. - Writing plan. - 1. The company and COVID 19. – IV. Research results. – CONCLUSIONS. - REFERENCES

### **Introduction**

4.0 technologies (MES and MOM systems mainly) were designed to enable the monitoring and control of industries in the early '90s (Meyer, Fuchs & Klaus, 2009). Despite this, it was in 2011 when the 4th industrial revolution took place, and the development of this type of tool was promoted (Almada Lobo, 2016). The 4th industrial revolution and 4.0 technology became fundamental for the industry, allowing efficient control of industrial processes. Thus, industry 4.0 was adopted and implemented in several organizations, the concept of Manufacturing Execution Systems (MES) in English Manufacturing Execution System (MES) pillar of technology 4.0 began to evolve, and operations control for manufacturing emerged in English Manufacturing Operations Management (MOM), a modernized version of the MES, which helped monitoring and control within the industry, allowed optimization of cost or quality control (Littlefield, 2012).

Given any forecast, during 2020, the world was affected by the COVID-19 pandemic, which, instead of undermining Industry 4.0 onwards I4.0, this pandemic became an opportunity for industries to modernize. Therefore, 4.0 technologies have similarly adapted to the new scenario, finding new ways to continue operating (Cauthen, 2020). The method used corresponded to the documentary review of records from various companies and their use of 4.0 technology before and during the pandemic. In addition to future projections on the development of both, a comparison was made between their effectiveness through the impact formula, managing to capture how COVID-19 benefited the development of these systems. In the Internet of industries and the industrial world in general (Lampropoulos, Siakas & Anastasiadis, 2019), there has been notable progress in refining methods that help to manage industries (Saenz de Ugarte, Artiba & Pellerin, 2009), and consequently, the importance of optimizing these methods is it has become increasingly larger over time (Mantravadi & Møller, 2019). These methods have generated a significant increase in the efficiency of the industries and the production obtained. Among these methods, two methods stood out above the rest: the MES and the MOM, which, over the years, evolved to become recognized processes.

The COVID-19 pandemic affected daily life, such as an assigned physical place, hours associated with activities, and face-to-face and vertical communication. Likewise, it forced industries to reformulate their work methods, for example, remote work from home, which enabled the use of technologies that were only for work use later. Under these premises, Industry 4.0 found its space in the modernization of work and in the implementation of innovative technologies which, far from making work more complex, we are optimizing it and giving it new paradigms which until just three years ago could have seemed unthinkable.

The method used in this work consisted of making maximum use of the impact formula since this allowed the efficiency of the MES and MOM to be measured numerically, comparing the data obtained between the pre-COVID and post-COVID times, with what we expect higher efficiency percentages to be obtained in the seconds, being able to support our theory. The investigation consisted of identifying how many companies have benefited from the technologies present in the company, such as MES, MOM, big data, and artificial intelligence, during the evolution of the COVID-19 pandemic. After this, the causes for which small and medium-sized companies (SMEs) were more affected than large companies by the COVID-19 pandemic. On the other hand, it was explained what motivated many companies to stop investing in Industry 4.0 and how many companies had few problems since they had an intelligent operating system.

## **Resolution scheme**

### **1. Research problem**

Was there any acceleration of companies due to COVID-19?

### **2. Methodology**

From the documentary analysis methodology, qualitative and descriptive approach, its applications in business organizations with global impact were emphasized. Among the main results, the validity of Amazon and Exscientia in using operational designs in the face of the crisis generated by the COVID-19 pandemic is evaluated.

To better capture the progress in Industry 4.0 during the pandemic, the impact formula ( $\% \text{ increase in the rate } R = (R_{\text{improved}} - R_{\text{actual}})/R_{\text{actual}}$ ), known as the Global Equipment Efficiency calculation in English, was implemented. Overall Equipment Effectiveness (OEE) is an indicator developed by the engineer and physicist Seiichi Nakajima. It is used to measure the efficiency of the equipment in an industry and is considered one of the main indexes for the analysis of industrial productivity (Almada-Lobo, 2015).

### **3. Writing Plan**

#### **3.1 The company and COVID 19**

Some questions arise about the impact generated by COVID-19. Suppose the pandemic started a new industrial revolution. In that case, that is, if industry 5.0 began to take its first steps since the relationship between technology and human beings had been increasingly interdependent so that "society 5.0, known as the super-intelligent society, can be the final bridge between machine and man." (Sarfraz, Sarfraz, Iftikar, & Akhund, 2021, p. 4) likewise,

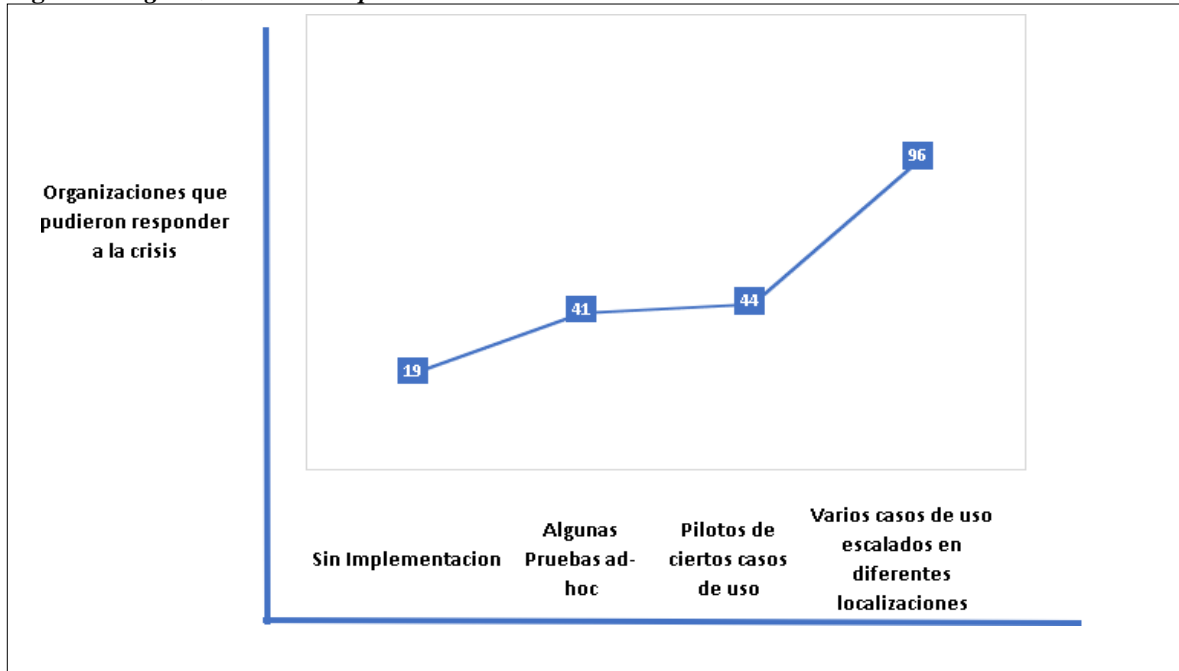
past revolutions arose largely due to existing problems in that context, which made it possible to stay on that path.

The global contingency that began in 2020 demonstrated the need to increase the requirement for new industry 4.0 technologies; for example, the Mexican company SensorGo offered products related to the Internet of Things. One of the products was cameras with sensors that, according to SensorGo, accurately identified people's body temperature beyond 99.00%. During the pandemic, one of the main symptoms was high temperature (SensorGo, 2020), for which SensorGo benefited from the high demand from public or private institutions. This situation was an opportunity to demonstrate that this type of technology, such as the Internet of Things (IoT), was increasingly essential.

The COVID-19 pandemic significantly affected small and medium-sized companies due to limited capacities and excessive demand for different products (Bandrés-Goldáraz, Conde-Casado & Iniesta-Alemán, 2021). It must be taken into account that Industry 4.0 encompasses the integration of modern technologies, which, thanks to these and by combining it with the Internet, emerged with flexibility, visibility, and reliability within the company (Bonci, Caizer, Giannini, Giuggioloni, Prist, 2023). According to the survey carried out by the authors and based on the 5800 SMEs, it was found that almost 50.00% were affected by the appearance of the pandemic since they did not have any Industry 4.0 technology. On the other hand, the companies with 4.0 technology (large companies) had no losses; on the contrary, there was a large increase in their sales and production (figure 1).

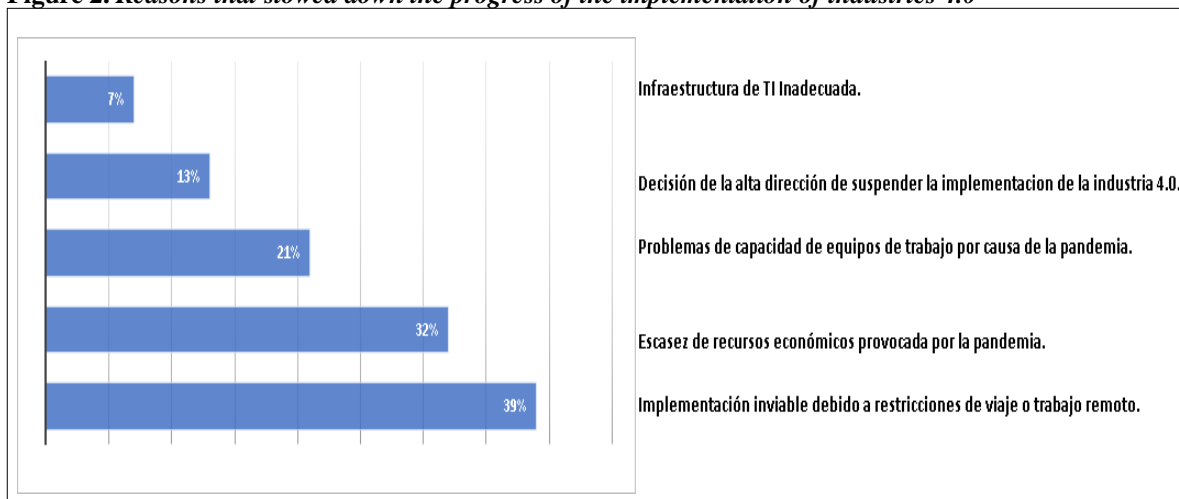
Agrawal, Dutta, & Millán (2021) found that Industry 4.0 is more valuable by 65.00%, the value of Industry 4.0 did not vary by 23.00%, and Industry 4.0 is less valuable by 12.00%. (Mayank-Agrawal, 2021). These data are curious because many companies had no MES or MOM system. Industry 4.0 refers to intelligent machines capable of 100.00% optimization of an organization's productivity, capable of making efficient decisions based on data and information, having better communication between the company and customers (better relationship), decreasing the time spent in manufacturing by having customer data and information and, finally, the reduction of defects. According to Agrawal, Dutta & Millán (2021), 56.00% of those surveyed who had not implemented Industry 4.0 technologies before COVID-19 found themselves limited in their response capacity given the absence of digital technologies to support them (figure 2).

**Figure 1. Organizations that responded to the COVID 19 crisis**



Source: taken from Agrawal, Dutta & Millán (2021, p3).

**Figure 2. Reasons that slowed down the progress of the implementation of industries 4.0**



Source: taken from Agrawal, Dutta, & Millán (2021, p. 4) .

#### 4. Research results

Table 1 shows the results of the OEE formula, from which it can be deduced that there was always an increase in production during the pandemic. Eurostat compiled the data in table 1 and represents the production volume of the main European economies between 2020 and 2021. In Accommodating, according to the observation made on other previous pages of the data collected, two months, one from 2020 and another from 2021.

The impact formula between the two was applied in order to give a percentage value to the increase in the volume of production present in such countries, where it was appreciated that the increase in the volume of production during the year 2021 was decisive in the result of the

percentage devised increase in production, giving in most cases a significant increase, almost always two figures in the percentage increase in production volume.

From the results, it was inferred that the pandemic slowed down production volumes and the increase in numbers during 2021 due to advances in technology and medicine, which helped to prevent the spread of the disease from remote work or home, the mandatory use of masks, moving in the same way to medical advances in record time in treatments and vaccines against the virus. Due to these and other factors, better numbers were projected in 2021, and this is in view when verifying, using the impact formula, that there is indeed a percentage increase in the production volume. It intensified increase since 2022 originated from the increase in the use of MES and MOM worldwide, where a higher assessment of the importance of these for an industry 4.0 was appreciated compared to previous years, and that is that during the pandemic of COVID 19, many companies went bankrupt or continued to survive barely. Thus, implementing optimization systems to the maximum in production, from one moment to another, became something fundamental in favor of organizational survival.

Another example of progress occurred in Amazon between 2019 and 2020. In 2019, the amount of operating money flow belonging to Amazon was 38.5 trillion dollars, compared to 2020, where 66 was appreciated. .1 trillion, showing an increase of 72.00% in 2020 compared to the previous year, evidencing how, during the year of the pandemic, there was indeed a notable increase in the company's production. Similarly, sales increased from 280.5 billion to 386.1 billion, producing an increase of 37.00% in 2020 compared to 2019. This data pair determined how the industry

4.0 helped Amazon generate even more profit than they already provided before the pandemic, clearly capturing the growth seen in systems like MES and MOM to help all these large companies take advantage of the tools in the best way possible and generate a considerable amount of profit.

Like Amazon, the company Exscientia was identified, which was dedicated to making drugs through the use of artificial intelligence and which was deeply benefited by the COVID-19 virus pandemic. Exscientia focused on making a cure for this disease, and this was demonstrated in the financial data of the company since in the first 9 months of the year 2021, the income amounted to 31.3 million dollars, an increase of 23.6 million in the first nine months of the year 2020 Thus, this information showed that there was an increase in productivity and use of Artificial Intelligence (AI) that year after year more companies incorporate into their environment to optimize management and operations. In addition, the "global survey on AI" conducted by McKinsey & Company between 2019 and 2020 described a 25.00% increase in the use of AI, which evidenced the growth of this technology and not only due to process optimization. Also, there was an increase in income since 63% of those surveyed stated that they had grown. Therefore, these data argue for the benefits of AI.

Based on the evidence of the cited investigations and duly completed with the critical analysis of the outstanding figures, "Up Supra" COVID-19 generated progress to Industry 4.0, as appreciated in the various figures compiled throughout the investigation. In the last couple of years, there has been an increase in production within industries and the technological field, with more and more companies integrating systems such as MES and MOM into their structure. According to Basco & Lavena (2021):

**Table 1. Production indicators Period 2020 to 2021 Europe**

Datos extraídos en 22/12/2021 15:40:05 desde [ESTAT]

Conjunto de datos:	Producción en la industria - datos mensuales [STS_INPR_M_custom_1808594]
Ultima actualización	2021
Frecuencia de tiempo	Mensual
Indicador de tendencia empresarial	Índice de volumen de producción
Clasificación estadística de actividades económicas en la Comunidad Europea (NACE Rev. 2)	Minas y canteras; fabricación; suministro de electricidad, gas, vapor y aire acondicionado

Periodo	2020-01	2020-04	2021-01	2021-10	Impacto % Aumento Abril 2020
Georreferencia (Etiquetas)					
Bélgica	112,50	94,80	120,50	131,00	38,20
Dinamarca	107,00	102,90	109,40	114,40	11,20
Irlanda	95,50	96,80	121,70		
Grecia	110,90	p 97,60	p 114,60	p 121,10	p 24,10
España	104,30	p 69,20	p 101,70	p 101,80	p 47,10
Francia	101,50	67,50	101,60	98,70	46,20
Italia	104,70	58,60	102,30	104,00	77,50
Países Bajos	102,60	94,00	101,40	p 103,40	p 10,00
Austria	118,20	86,70	114,60	119,40	p 37,70
Polonia	123,30	91,60	129,80	139,30	52,10
Portugal	107,10	74,40	100,90	98,60	32,50
Suecia	111,20	92,70	111,60	115,00	p 24,10
Noruega	98,20	101,50	103,20	103,90	2,40
Suiza	119,50	106,60	118,70		
Reino Unido		100,90	77,70		
Turquía		117,40	79,10130,70	137,60	74,00

Fuente: Eurostat.

**Source:** Data obtained from Eurostat (2021). [https://ec.europa.eu/eurostat/databrowser/view/STS\\_INPR\\_M/default/table?lang=en](https://ec.europa.eu/eurostat/databrowser/view/STS_INPR_M/default/table?lang=en)

Cloud computing was the one with the greatest penetration and acceleration in the region. On average, 29% of companies continued to use it during the pandemic, while another 26% joined for the first time. The countries that have shown the greatest increase in the use of this technology are Argentina (+28%), Chile, and Mexico (+27%). Other instruments that were also consolidated were digital platforms, mobile services, big data, and data analysis (they were adopted by 19% of companies and are currently used by 41% of firms (p. 26).

The previous fragment corresponds to a part of the results of the research carried out by the Inter-American Development Bank by Basco and Lavena (2021), who described that at the Latin American level, there was a strong increase in the application of tools related to Industry 4.0. Apart from this, in the same investigation, it was stated: “The results of this investigation show the acceleration in the technological incorporation in Argentina, Brazil, Chile, Colombia and Mexico for all the technologies of industry 4.0. surveyed” (Basco & Lavena, 2021, p. 27)

## Conclusions

The pandemic initially aimed to slow down the industry and induce one of the worst, if not the worst, economic crises in history, but ended up being the opposite for Industry 4.0. Industry 4.0 became a savior so that modern industry would not stop and continue with its usual operation, even improving, as we have already elucidated in several cases. The COVID-19 crisis led to using several new, or rather not-so-new, technologies within the industry, which allowed it to continue operating even when it was not managed directly by the company. Big Data, IoT, IA, and VR, among other technologies already existing but not known or used in the workplace, helped the survival of these industries. Industries that did not have Industry 4.0 technologies were forced to adopt them immediately, or they could lose their position in the industry.

Comparisons with the main European economies were appreciated; in the first months of the pandemic, there were low production indices, or below those of a normal year. Although the numbers were going down in 2020, in 2021, they showed a significant and unexpected rebound, linked to a large extent to the adoption of new technologies, optimization, and forms of organization familiar to I4.0, which also landed in Health items and helped prevent the spread of the virus. On these considerations, authors such as Kumar, Sharma, Singh, Naugriya, Singh-Gill & Buyya (2021), Nascimento-Junior-Santos, Cavalcante, Quintans-Junior, Walker, Borges & Serafini (2021), Armani, Hurt, Hwang, McCarthy & Scholtz (2020) and, Yan, Hai-Tao, Yang, Maolin, Yuqi, Chuan, Xiuchuan, Liang, Shusheng, Mingyang, Ying, Haosen, Yanyan, Tongxin, Junyang, Fang, Yanru, Sufang, Xi, Niannin, Bo, Yong, Ailin, Zhiguo, Hui & Ye (2020), reported similar findings.

Adopting these technological advances would be essential in the future for any industry and its survival, as in the case of Amazon. This company survived this crisis and knew how to use it as a springboard toward a more prosperous future for itself. Same. Industries that did not possess these technologies saw their plans delayed, went bankrupt, and ceased to exist. These advances similarly benefited health because new working and teaching methods were discovered, partly thanks to the pandemic. (Bandrés-Goldáraz., Conde-Casado & Iniesta-Alemán, 2021).

Finally, reaching a general conclusion would be that the future is in the short term; it is uncertain, and with opportunities, without Industry 4.0, it is possible to inhibit tools to cope



with this pandemic. The advances of these technologies will become essential in the long term to benefit the potential of the next crisis, which demands the installed capacity of the productive systems in their efficiency and effectiveness, considering that we abuse this technology that we so often use. Without suitability, one can focus on emerging scenarios in the future.

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