BJ O&PM Brazilian Journal of Operations & Production Management

ISSN 2237-8960 (Online)

ABEPRO ASSOCIAÇÃO BRASILEIRA DE ENGENHARIA DE PRODUÇÃO

RESEARCH PAPER

Productivity in a pandemic: effect of occupational health conditions and digital communications in the manufacturing industry

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How to cite: Hernández, S.R., Martínez, M. A. D. and Zubirías, G. C. (2023), "Productivity in a pandemic: effect of occupational health conditions and digital communications in the manufacturing industry", *Brazilian Journal of Operations and Production Management*, Vol. 20, No. 4, e20231642. https://doi.org/10.14488/BJOPM.1642.2023

ABSTRACT

Goal: The purpose of the study is to identify how Occupational Health conditions and digital communications are related to Productivity in times of pandemic in the manufacturing industry on the Tamaulipas and Texas border.

Design / Methodology / Approach: An own instrument was designed for this study; it was applied to 104 informants with responsibility in productive areas in the manufacturing industry; the analysis was performed with SmartPLS.

Results: a positive relationship was identified between independent variables of Digital Communications and Occupational Health conditions with respect to the dependent variable Productivity and they explain 69.8% (R2); workers gave more weight to the relationship between Occupational Health conditions with Productivity (51.5%), than to the relationship between Digital Communications and Productivity (39.2%).

Limitations of the investigation: the study was analyzed from the perspective of the worker; participation was limited due to access issues due to the pandemic.

Practical implications: the study shows an analysis procedure with PLS.

Originality / Value: The article shows its relevance by presenting a model to establish relationships between worker health conditions and digital communications with an effect on labor productivity that will have an effect in the post-pandemic.

Keyword: Productivity; Occupational health; Communication, Pandemic.

INTRODUCTION

With the emergence of theCOVID-19 pandemic, governments in different countries established confinements of people to contain infections around the world; a situationthat led most companies to propose work from home; with the benefit of promoting health, safety and ensuring productivity (Seva et al., 2021; Patanjali and Bhatta, 2022; Toscano and Zapalá; Akif et al., 2021).

To describe what COVID-19 is, it can be mentioned that it belongs to a family of viruses that cause serious diseases such as severe acute respiratory syndrome caused by "SARS-CoV-2"; this virus attacks all types of people, who sometimes present serious complications; highlighting affectations to people in previous conditions of diseaseis of the heart, pulmonary, diabetes, obesity and is complicated in older adults (Cesare et al., 2020; Betacourt et al., 2020; Chirico and Magnavita, 2020).

Financial support: None.
Conflict of interest: The authors have no conflict of interest to declare.
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Received: 29 August 2022.
Accepted: 20 March 2023.
Editor: Julio Vieira Neto.

For Nguyen and Tran (2021), COVID-19 spreads around the world, causing people to perceive behavioral changes in their environment; organizations that kept their operations active tested their productive flexibility and commitment to society. Even so, productivity in organizations was affected, the risk of getting sick increased in workers; although occupational health standards recommended by authorities have been implemented and organizational support for the worker was improved.

Since the beginning of the pandemic, an increase in productivity has been detected; however, in previous studies they have not been decisive in validating this point; there are three components of productivity growth: the first, quality of labor determined by the skills and abilities of the worker; the second, deepening of capital when companies acquire new equipment, automate processes or invest in new plants; third, it is an indirect measure of innovation, explained by the residual portion of productivity that cannot be explained from the quality of labor and the deepening of capital (Fernald, 2021; Obrenovic et al., 2020).

Organizations are constantly updated to be competitive, implement various strategies to maintain high levels of productivity; workers are part of these strategies and adapt immediately to the required needs. The improvement activities undertaken by the organization are agents of change that motivate and generate a virtuous circle that potentiates the productivity of the company (Young and Brand, 2005). In organizational productivity, scientific management principles are considered, such as measuring and improving; this allows boosting competitiveness in any company, establishing a convenient relationship between efficiency and effectiveness for the achievement of organizational objectives (Ekpenyong, 2021; Suhardi et al., 2021).

In the business context, the maquiladora industry on the border between the United States of America (USA) and Mexico has been a strong promoter of commercial development between both countries, trade agreements have strengthened this relationship; the need for goods and services for the maquiladora industry has increased; on the other hand, employment and the development of border cities are promoted (Cañas et al., 2013). The maquiladora industry has an important share at the global level, it represents an opportunity for the development of emerging markets; competitive labor is required to attract more international investment (Onaran, 2009).

The impact of this sector indicates that in November 2020, imports from the Mexican maquiladora industry totaled USD 217,053 million, likewise, exports totaled USD 235,493 million; on the other hand, in December 2020, 2,695,964 direct jobs were generated nationwide; manufacturing systems have high technology and production optimization, with methodologies such as: Lean manufacturing, Lean manufacturing, Total productive maintenance, Jidoka and General equipment efficiency, to keep the equipment in optimal operating conditions (García et al., 2022).

For authors such as Shoss (2021), it indicates the importance of health conditions through Occupational Health during the COVID-19 pandemic; trying to understand this phenomenon from a psychological approach, identifying how it develops in organizations to mitigate its effects; in addition to providing guidance in companies and formulating government policies to have better tools in future crises. In this sense, Burdorf (2020) mentions that companies will have to deal with the psychological consequences of the pandemic on their workers, especially in health sectors; but with influence on face-to-face workers in other sectors.

Occupational health and communication technology was strengthened in different operational areas in organizations to improve their relationship with productivity and sometimes work from home; although not all the workers of the companies were able to do work at home; this research is focused on those manufacturing organizations, which had to maintain most of their operations in person. The objective of this study is to identify how occupational health conditions and digital communications are related to Productivity in the manufacturing industry in times of pandemic.

Literature review and hypothesis development

The literature review of the study variables and their relationships is indicated; as well as the proposal of the hypotheses for each relationship, which are described below.

Occupational Health conditions and productivity

Workers worldwide face risks in their work environment, injuries, accidents, illnesses, disability and death; During 2020, the International Labor Organization (ILO) reported 300 million accidents and 160 million work-related illnesses; a safe work environment benefits aspects such as the biological, physical and psychological aspects of workers; during the pandemic, technology services were important in occupational health and safety management; the use of technology is considered to increase the pace of work and benefit productivity (Okeke, 2021).

The worker has the perspective that at any given time he may suffer some type of accident that affects his health, predisposed by the statistics of annual accidents; he feels the need to carry out some coordinated action with the organization to solve this potential problem (Lingar, 2013). This

type of thinking is explained from the theory of organizational support, in which workers consider it relevant that the company acquires a commitment to the health of the worker; on the other hand, in the theory of social exchange the worker manifests a feeling of gratitude for the pursuit of his health and does his best for the company as remuneration (Kaynak et al., 2016).

For Núñez (2011), Occupational health conditions in the organization has as its focus on preventing accidents, protecting intangible resources such as information, knowledge, digital communication networks and worker skills; it has different effects on the workers of the company, motivates morale, productivity management and cost reduction; In addition, it allows to propose new models of occupational health management of accident prevention. The preventive measures of occupational health applied in the organizations were not always well received by some sector of workers; given the beliefs and cultural values that the COVID-19 Virus did not exist, it was necessary to work on worker awareness and in some cases with disciplinary measures to manage and control the spread in the workplace (Sauti, 2020).

For Kodjo et al. (2009), the staff of a company that feels integrated to it, is a promoter of productivity in all the activities carried out and especially in those when the company needs it most. It becomes a strategic ally, with the ability to positively influence its colleagues to achieve planned company objectives. Occupational health conditions have become very relevant in different parts of the world, one in three European workers fears that their health and safety are in danger due to their work, they perceive a high risk of contracting diseases and having serious accidents; they consider that the company must guarantee better safety conditions at work to obtain better financial benefits (Cuc, 2022).

Companies face continuous challenges in their workforce, try to maintain optimal levels of productivity; seek favorable health conditions in their production lines; the relationship between health and productivity becomes a strategic factor of the company to maintain optimal levels of productivity in workers (Kirsten, 2010). In this sense, industrial production is continuously updated, the changes generated have an influence on the worker's environment, on their quality of life and are reflected in productivity; In the workplace, the worker has had to adapt to these changes to stay current, given the appearance of new autonomous production teams (Grenčíková et al., 2020).

Daily work is a means to meet the needs of the worker and their families, it is classified by level of achievement achieved from the perspective of quality of life (Araya and Pedreros, 2013). Other aspects of work are related to theconditions of safety, hygiene and a treatment with a human approach (Durán, 2010). Hygiene and safety are factors that affect productivity; They also raise the perception of workers' quality of life (Feltner et al., 2016).

The factors that generate satisfaction at work change with respect to time, the aspects of financial security have allowed workers to be more loyal to the company; on the other hand, sometheories such as he rzberg's factors, have identified intrinsic factors such as: responsibility, achievement, recognition and work; that are related to worker satisfaction; on the other hand, extrinsic factors such as: hygiene are related to dissatisfaction (Dhir et al., 2019).

For Cardoso et al. (2021), the inclusion of occupational health practice in organizations has been of great benefit to workers this practice was developed to control the overexposure of employees to risk; with the emergence of COVID-19, some concern has been created among employees who carry out activities considered essential; the World Health Organization (WHO) has forced to take measures to address practices to combat Covid-19. From this perspective, the following hypothesis is proposed.

H1: Occupational Health has an influence on worker productivity.

Digital communications in productivity

For Aday and Seckin (2020) the measures of restrictions implemented by pandemic, caused closures in some productive sectors and work at home was promoted by digital communication method; however, not all companies and not all workers could use that option.

For Erazo et al. (2020), Information and Communication Technologies (ICTs) have generated a process of connectivity unprecedented in human history, by multiplying the possibility of generating and socializing knowledge, without space-time barriers; what, they can also reduce costs, improve efficiency of operations and reach new markets. Communication technology manages and processes information that facilitates intercommunication between elements of the process; this tool allows information processing, voice, data, text and image management; this technology influences the economy through productivity development (Riascos et al., 2020).

Communications are components used for smart manufacturing, they are present in productive sectors, the concept is associated with industry 4.0; The German industry is a world leader in this field and emphasizes the automotive industry. The technological purpose is to build a flexible production model with real-time interaction between people and production processes by electronic means (Zhou et al., 2015).

The Internet of Things has given rise to intelligent production, the concept "The Cloud" is another element used in communications; this technology enables new ways of producing, such as smart production; this scheme of industrial production through communications technology is widely accepted in this sector (Kunst et al., 2019; Li et al., 2015). Communication technology transforms traditional industries into intelligent industries such as Industry 4.0, which today moves autonomous robots, enables simulation, the Internet of things, data security, cloud computing, big data, additive manufacturing and data analysis (Kunrath , 2022).

To measure productivity, parameters such as production and performance have been established; other challenges are to measure productivity in workers who do not have fixed tasks and standardized production times. In previous studies, dimensions have been used to measure productivity, such as: quality, results and costs; but apparently, there is still no effective method to measure it (Ramírez and Nemnhart, 2004).

Companies are looking for appropriate strategies to improve productivity and indicators to face their competitors with better arguments (Vélez, 2010). In the implementation of improvement activities, it is convenient to raise awareness among the staff to obtain greater acceptance and support; it is necessary to maintain good industrial relations and include the participation of the worker in decision-making; productivity is an indicator of organizational efficiency that incorporates knowledge and skills from the company's human capital (Reina, 2016).

In today's organizations, work teams with better productivity outcomes promote high levels of communication and interdependence (Appelbaum et al., 2005; Fassoulis and Alexopoulos, 2015; Khalid and Masood, 2007; Shikdar and Das, 2003). New concepts such as social manufacturing emerged from the pandemic when the health supply chain was affected, anyone from home with a 3D printer could make their own designs for masks and facials; this type of social organization is an example that industries can benefit from the concept of social manufacturing, where the consumer is part of the production system; interesting relationship for analysis in current production models (Zanella et al., 2022). From this perspective, the following hypothesis is proposed.

H2: Communications have an influence on Productivity

Digital communications have an influence on occupational health

For Larochea et al. (2020), organizations seek safety and health at work; traditional prevention programs focus on protecting workers and the workplace being safe, since there is a correlation between the health of the employee and the productivity of the organization. With the advent of digital communication technology, new opportunities have opened up in the company, which allow workers to communicate messages, order files related to their work and disseminate achievements in their areas. According to Peltomaki and Husman (2002) in occupational health conditions, the employer is obliged to perform health services for employees; information and communication technologies reduce contact between people in a physical way efficiently.

The Internet of Things (IoT) technology is used in communication models such as Industry 4.0 to improve productivity; in some cases, it is supported by 5G technology that strengthens social communication networks, widely used in companies to improve efficiency and security (Vilela and Faria, 2022). Health conditions gave rise to new concepts related to productivity through electronic media.

Research work on training and communication technologies in the field of occupational health has evolved rapidly, derived from the effect of the pandemic on worker stress and well-being; Some theories on stress and motivation are used in research focused on work areas (Hu et al., 2021). On the other hand, the perception of some workers about its use in times of pandemic is that it affects the balance between work, family and job satisfaction; companies must ensure a sensible management of communication technology in work environments (Ninaus, 2021).

For Ngubo et al. (2016), new technologies have led to the emergence of Wireless Sensor Networks (WSN) used in health and safety systems to monitor the well-being of workers, especially in high-risk environments; the technology allows to monitor physical aspects of the worker, such as: the safety equipment he is wearing or if he presents any erratic behavior. From this perspective, the following hypothesis is proposed.

H3: Digital communications have an influence on health occupation.

METHOD

To carry out the study, the variables of Occupational Health Conditions (SALOC), Digital Communications (COMUN) were used as independent variables and as a study variable or dependent Productivity (PRODU). To obtain the information, a measuring instrument of our own design was built, it was applied to 104 informants with a level of responsibility in production areas

of the manufacturing industry, located in the border area between Reynosa Tamaulipas, Mexico and the State of Texas, USA.

The number of survey items was twenty-three; of which, for the variable Occupational Health Conditions were indicated with eight, Digital Communication with seven and Productivity with eight. For the answer options, the Five-Option Likert Scale was applied. In this study, multivariate statistics were used to identify the relationship between study variables. For the design of the instrument, current literature was used to construct the study variable "Construct", measurement indicators were identified and the questions associated with each indicator were proposed; the structure of the measuring instrument is found in Annex 1.

The procedure for the application of the self-designed instrument was carried out in an orderly manner during the months of October and November 2021, in the midst of the country's economic reactivation process. The objective was to identify the relationship between the conditions of Occupational Health, Digital Communications and its effect on the Productivity of the manufacturing industry in the border area of Tamaulipas with Texas in the time of the COVID-19 pandemic. Values of reliability and validity of the measuring instrument such as Cronbach's Alpha and AVE were identified. SmartPLS statistical software was used for analysis.

Characterization of variables

To identify how the study variables are constructed can be described from items that compose them, this relationship is indicated below.

Productivity (PRODU).- the list of questions that make up the variable, are: level of competitiveness that the worker perceives when he performs assigned activities, when the work team provided by the organization is adequate for his tasks, has indicators to measure productivity, the worker is free to make proposals for improvement, considers that in his work he has produced savings to the company without reducing productivity, visualizes that the company uses human talent in an appropriate way, the worker is aware that if the company does well it will have some benefit.

Health Conditions occupational (SALOC).- the list of questions that make up the variable, are: the worker perceives that the company where he works makes visible safety policies and healthy distance; the physical conditions of ventilation are adequate to do his job; COVID-19 prevention measures are applied; he has adequate space to do his work, he has basic knowledge to identify suspected cases of contagion; he locates if the company has a security system and health (OHSAS), takes care in its work despite the safety standards established by the company.

Digital communications (COMUN). – the list of questions that make up the variable, are: the worker identifies that the company has a data network in operational areas; the company makes use of wireless networks for laptops, cell phones and other mobile devices; the company has a control network for temperature, surveillance, light, access and other devices; the company has a specific area for administration of voice and data communications; as well as, it has access by fiber optics and Internet.

RESULTS

Statistical reliability tests of the measuring instrument

The Productivity construct (PRODU) for this case identified as a dependent variable; Digital Communications (COMUN); Occupational Health conditions (SALOC) are identified as independent variables and were evaluated using an instrument of our own design subjected to statistical tests, such as Cronbach's Alpha, Extracted Mean Variance (AVE), Composite Reliability (CR) and the Inflation factor of Variance (VIF); with Cronbach's Alpha test the internal consistency of each variable is identified, the correlation between the items that compose it is quantified (Celina and Campo, 2005). Cronbach's Alpha values are identified by variables such as PRODU (0.91), COMUN (0.86) and SALOC (0.90); the values presented are above 0.7 recommended by Escobedo et al. (2016); For Hair et al. (2010) it recommends values higher than 0.7.

For the Extracted Mean Variance (AVE) test, the observed values were between 0.59 and 0.63; above the recommended value of 0.5 for AVE; this indicates that the construct explains at least half of the variance of observed variables (Hair et al., 2016). The estimated values of the Inflation Factor of Variance (VIF) allow us to affirm that there is no manifest or relevant multicollinearity between pairs of constructs; the maximum VIF value identified was 1,91, for Belsley and Welsch (1980) recommend a value of 3 and a maximum of 10. The Values of Composite Reliability are indicated in Table 1.

Table 1 - Reliability validity of the instrument using Cronbach's Alpha, AVE and VIF

Variable	Items	Alpha Cronbach	CR	AVE	VIF
COMMON	P1, P3, P4, P5, P6, P7	0.86	0.89	0.60	1.91
SALOC	P8, P9, P10, P11, P12, P14, P15	0.90	0.92	0.67	1.91
PRODU	P16, P17, P18, P19, P20, P21, P22, P23	0.91	0.92	0.61	Dependent variable

Source: Own elaboration.

For the data analysis, the SmartPLS software was used, this tool allows to observe latent variables such as (COMUN, SALOC and PRODU) and the manifest variables used for each Variable (Construct).

Route model results and factor loads

The tests carried out with the SmartPLS statistical software allowed to identify the load factors for each item; with these data, the number of items used for each study variable was adjusted; only those representative values greater than (0.50) were accepted, because these values explain more than 50% of the variance. The items that were removed are indicated below, for the variable COMUN (p2); the variable SALOC (p13) and the dependent variable PRODU none were removed.

The load factors located above 0.5 in each variable are indicated below; for Digital Communications (COMUN) it is integrated by the items (p1=0.71, p3=0.74, p4=0.75, p5=0.77, p6=0.87, p7=0.77); the variable of Occupational Health conditions (SALOC) are indicated (p8=0.80, p9=0.70, p10=0.86, p11=0.82, p12=0.80, p14=0.76, p15=0.81); for Productivity (PRODU) the items are (p16=0.76, p17=0.82, p18=0.73, p19=0.73, p20=0.86, p21=0.82, p22=0.83, p23=0.70).

For Fornell and Larcker (1981), the load factors are indicated in the exploratory factorial analysis for cross-loads and cross-loads of the three-dimensional elements; likewise, the convergent validity was verified by analyzing the loads of the factorial elements, to identify that all the loads were above 0.7, see in Table 2.

Table 2 - Cross table

Ítem	COMMON	SALOC	PRODU
P1	**0.71**	0.49	0.53
P3	**0.74**	0.52	0.52
P4	**0.75**	0.50	0.48
P5	**0.77**	0.43	0.57
P6	**0.87**	0.69	0.69
P7	**0.77**	0.51	0.61
P8	0.58	**0.80**	0.62
P9	0.43	**0.70**	0.55
P10	0.57	**0.86**	0.61
P11	0.48	**0.82**	0.61
P12	0.58	**0.80**	0.61
P14	0.60	**0.76**	0.71
P15	0.57	**0.81**	0.62
P16	0.63	0.60	**0.76**
P17	0.65	0.62	**0.82**
P18	0.47	0.59	**0.73**
P19	0.56	0.46	**0.73**
P20	0.62	0.67	**0.86**
P21	0.57	0.65	**0.82**
P22	0.62	0.71	**0.83**

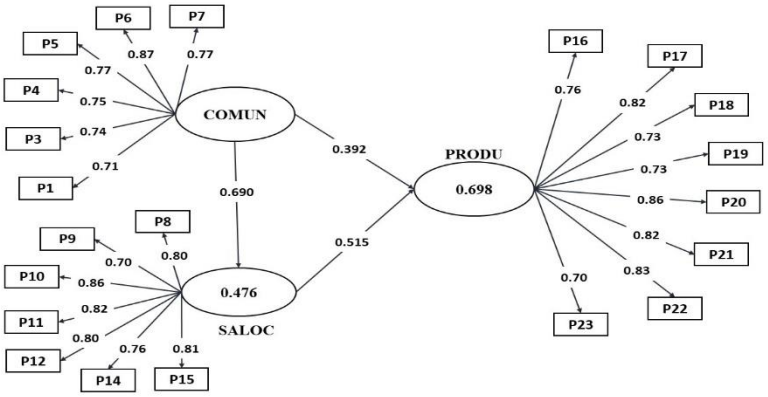
P23	0.54	0.58	**0.70**

Source: Self-made table with SmartPLS data.

The diagram of the route model and factorial loads obtained with the SmarPLS statistical software that accompany the study, the relationship between variables and R2 is indicated with a value of 0.698, is indicated below in Figure 1.

El esquema del modelo de ruta y cargas factoriales obtenido con el software estadístico SmarPLS que acompañan al estudio, la relación entre variables y la R2 se indica con un valor de 0.698, se indican a continuación en la Figura 1.

Figure 1 - Route model results and factor loads.



Source: own elaboration with data from the SmartPLS.

In this research, the hypothesis tests were determined by the trajectory coefficients, as well as by t-statistical values obtained in the PLS start-up model; likewise, the effect size (f2) was identified in the PLS start-up model. The effect size is considered according to its values: from 0.35 upwards it is strong; from 0.15 moderate and 0.02 weak (Henseler et al., 2016). The data are shown in Table 3.

Table 3 - Result of the analysis of the structural equation model

Route	Hypothesis	Route coefficients (β)	t-statistical	P value	f^2	Decision
COMMON → PRODUC	H_1 (+)	0.392	3.876	0.00	0.266	Significant moderate
SALOC → PRODUC	H_2 (+)	0.515	5.141	0.00	0.460	Significant Strong
COMMON → SALOC	H_3 (+)	0.690	9.352	0.00	0.910	Significant Strong

Source: own elaboration with data from the SmartPLS.

Moreover, the goodness of fit (SRMR) test for this model is 0.083. The description of values found for hypothesis testing is given below.

Hypothesis Test 1. the data identified for the relationship Digital Communications (COMUN) and Productivity (PRODUC), are indicated in Figure 1 and Table 3, the values of the route coefficient (β) is 0.392, while for the t-statistical value it is 3.876; these values indicate that digital communications have a moderate statistical influence on Productivity; for these values, the H1 proposal is accepted.

Hypothesis Test 2. The data identified for the relationship between variables Occupational Health conditions (SALOC) and Productivity (PRODU), are indicated in Figure 1 and Table 3; route coefficient values (β) of 0.515 and t-statistical value of 5.141 are located; This relationship of variables indicates that Occupational Health conditions have a strong statistically significant influence on Productivity; For these values, the proposal of H2 is accepted.

Hypothesis Test 3. the data identified between the relationship of the variables Digital Communications (COMUN) and occupational health conditions (SALOC), are indicated in Figure 1 and Table 3, are located values of the route coefficient (β) of 0.690 and the t-statistical value of 9.352; this relationship indicates that digital communications have a strong statistical influence on the Occupational Health Conditions; for these values, the proposal of the H3 is accepted.

DISCUSSION

The relationship between Digital Communications (COMMON) and Productivity (PRODU) is moderate and positive, it corresponds to H1 with a coefficient of (β) of 0.392; for Morrar et al. (2019) mentions that the use of digital communications positively influences the productivity of the company through innovation and technological development. Likewise, Nowrouzi et al. (2021) indicates that, if there is a positive effect between Communications and productivity, it also promotes a healthy work environment for the mental health of workers, guaranteeing operational continuity in times of pandemic.

For Mustafa (2020), the disruptive effects of the pandemic had a positive effect on the digital adaptation of people, processes, and health policies in work areas to maintain productivity; it is very likely that the nature of another opportunity to collaborate globally and be prepared to digitally transform towards a sustainable future. For Buomprisco et al. (2020) establishes positive benefits in productivity when working from home; however, it states that this modality can affect physical and psychosocial health; the International Labor Office in 2020 made useful recommendations to prevent health risks derived from teleworking.

According to Guzmán (2022), in April 2020 the pandemic had infected workers in the oil industry considered an essential activity, the mortality rate in this sector was seven times higher than in other industries; the impact of the pandemic on the issue of safety at work has not yet been widely measured; some aspects of safety have been investigated from a psychological approach, behavior culture, use of mobile devices and technology in occupational safety.

The relationship between Occupational Health conditions (SALOC) and Productivity (PRODU) is moderately strong is moderately strong and positive, it corresponds to H2 with a coefficient of (β) of 0.515; for Peters et al. (2022) during the pandemic, a positive relationship between work and occupational health could be established; well-being and mental health are aspects that influence the quality of life of the worker with an effect on productivity. For Ramos et al. (2022) from an ergonomics approach, the physical well-being and mental health of the worker is promoted, as a strategic part of occupational health that seeks job satisfaction. On the other hand, Ruiz et al. (2021) indicates that workers will have a long-term negative effect due to psychological effects caused by the pandemic; therefore, preventive measures must be taken to address this aspect.

For LaDou (2003) he points out that the industry generates benefits and raises the quality of life of workers in countries where it is implemented; but globally, the International Labor Organization (ILO) states that the workforce suffers 250,000 accidents per year; on the other hand, the World Health Organization (WHO) estimates that there are 217 million diseases per year. In this sense, Badri et al. (2012) states that the industry manages Occupational Health to minimize work risks, ensure safe facilities, implement strict safety standards; still, accidents keep showing up.

The relationship between Communications (COMUN) and Occupational Health conditions (SALOC) is strong; For Saeed (2020), communication technologies maintained a combat front against the pandemic, informed about its evolution, trained company workers and allowed medical automation; Likewise, they influenced the survival of the economy, the automation of the supply chain and electronic commerce were strengthened and they supported risky occupations; On this basis, communication technologies will be of great help in the post-pandemic.

The relationship between Digital Communications (COMUN) and Occupational Health conditions (SALOC) is strong and positive, corresponds to H3 with a coefficient of (β) of 0.690; For Saeed (2020), communication technologies maintained a combat front against the pandemic, informed about its evolution, trained company workers and allowed medical automation; likewise, they influenced the survival of the economy, the automation of the supply chain and electronic commerce were strengthened and they supported risky occupations; On this basis, communication technologies will be of great help in the post-pandemic.

Communications technology in fixed or mobile networks maintained a positive effect on the production of goods and services; Institutions and industries have had to rely on communications for the continuity of operations, on the other hand, a society that is more adaptable to difficult circumstances such as a pandemic has developed (Abubacar et al., 2020; Siriwardhana et al., 2020).

For Leso et al. (2018), they consider that new technologies are allowing digital infrastructures, design solutions to prevent, control safety and health risks in the worker; likewise, specific safety training should be provided when changing workplaces or when adopting new technology. On the other hand, Tovalin (2005) points out that workers in the industry are exposed to different risk factors, the modernization of production processes and the improvement of working conditions will prevent injuries to personnel; although workers have protective equipment and have had training, the prevalence of accidents indicates that there is no good preventive or monitoring programs.

CONCLUSIONS

The relationship between the study variables Digital Communications (COMUN), Occupational Health Conditions (SALOC) and Productivity (PRODU) in the manufacturing industry in times of pandemic is presented as follows.

For the COMMON→PRODU relationship, it is a significant but moderate relationship, that is, in this relationship it contributes 39.2%, the heaviest loads are located in Figure 1; workers perceive that the company has communication networks in operational areas (p6), locate that the company has voice and data in internal communication (p5) with Internet service (p7); Likewise, it identifies that the company has an improvement program for technology implementation (p17), that it has an adequate strategy to plan and control production lines (p20), the worker feels heard when he makes contributions for the benefit of productivity (p21), the worker perceives that the company has identified the technology with an impact on production (p22).

Regarding Occupational Health (SALOC) with Productivity (PRODU), that is, this relationship contributes 51.5%, the heaviest loads are located in Figure 1; The worker feels safe in his work area (p8), considers that the company applies prevention health standards (p10), considers that he has been trained in health prevention situations (p11), also considers that the company has a occupational health and safety (p12) and if given the opportunity, they would be vaccinated as a health prevention measure such as COVID-19 (p15); likewise, he identifies improvement programs for the implementation of technology (p17), an adequate strategy to plan and control production lines (p20), he feels heard when he makes contributions for the benefit of productivity (p21) and perceives that the company has technology impact on production (p22).

For Digital Communications (COMUN) and Occupational Health conditions (SALOC), that is, the relationship between these two variables is 69.0%, those with heavier loads are located in Figure 1; workers perceive that the company has communication networks in operational areas (p6), locate that the company has voice and data in internal communication (p5) with Internet service (p7); likewise, he identifies improvement programs for technology implementation (p17), an adequate strategy to plan and control production lines (p20), he feels heard when he makes contributions for the benefit of productivity (p21) and perceives that the company has technology that has an impact on production (p22).

Finally, a positive relationship can be indicated between the independent variables of Digital Communications and the conditions of Occupational Health with respect to the dependent variable Productivity and they explain 69.8% (R2). It was possible to identify that the workers gave more weight to the relationship between Occupational Health conditions with Productivity (51.5%), than to the relationship between Digital Communications and Productivity (39.2%); that is, the worker feels safe in the company, perceives the implementation of safety regulations, feels trained, identifies benefits in communication systems, perceives the existence of an Occupational Health system; identifies benefits in the use of the Internet and communication networks; they feel listened to and make contributions for the benefit of productivity.

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Author contributions: SRH: Develop the hypothesis, structure the method, develop the measurement instrument, collect data and analyze the statistical results. In addition to monitoring the final document; MADM: Review the literature, review the measurement instrument with statistical software, coordinate logistics work, collect data and present important suggestions; GCZ: Collect data, present important suggestions, review reliability tests of the measuring instrument and support in application logistics.

Annex 1 - Structure of the measuring instrument

Variable	ID	Items
Digital Communications (COMUN)	P1	Do you consider that the company has an internal data network in operational areas?
	P3	Do you consider that the company uses wireless networks for laptops, cell phones and other mobile devices?
	P4	Do you consider that the company has a network of nodes for temperature control, surveillance, light, access and other devices?
	P5	Do you consider that the company has a special control area for voice and data communications?
	P6	Do you consider that the company complies with cabling and communications security standards?
	P7	Do you consider that the company has a fiber optic link and other Internet services?
Occupational Health conditions (SALOC)	P8	Do you consider that your workplace has adequate physical space to feel safe without health risks?
	P9	Do you consider that the physical ventilation conditions are adequate to carry out your activities?
	P10	Do you consider that the company where you work applies preventive measures health?
	P11	Do you consider that you have been trained to apply prevention measures with people suspected of COVID-19?
	P12	Do you consider that the company has an occupational health and safety management system?
	P14	Do you consider that you have to be careful in your work to avoid risk of injury?
	P15	Do you think that if you had the opportunity to get vaccinated against COVID-19, you would do so?
Productivity (PRODU)	P16	Do you consider that the company has a flexible production to react to an increase in customer demand without incurring excessive costs and resources?
	P17	Do you consider that the company has a program to improve production systems to promote the implementation of technology?
	P18	Do you consider that the company manufactures for a product or a family of products?
	P19	Do you consider that the company manufactures different products and packaging sizes?
	P20	Do you consider that the company has the appropriate strategy to plan and control production lines to manage downtime and improve productivity?
	P21	Do you consider that you are listened to when you make a proposal to improve productivity?
	P22	Do you consider that the company has identified the technology that has a positive impact on production?
	P23	Do you consider that the organization allows you to make adjustments in process lines to improve productivity?
A Likert scale with five options was used: 1) Totally disagree; 2) Moderately disagree; 3) Neither agree nor disagree; 4) Moderately agree and 5) Totally agree.		
Control data were requested such as: Age, Education, Marital Status, Number of children and Seniority in the position.		