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# Safety and health at work management model for autonomous telework in Colombia*

## Modelo de gestión de la seguridad y la salud laboral en el teletrabajo autónomo en Colombia

## Modelo de gestão de segurança e saúde no trabalho no âmbito do teletrabalho autónomo na Colômbia

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# ABSTRACT

The results of this paper are determined by the guidelines and regulations applicable to teleworking in Colombia in terms of occupational health and safety, to the design of the Occupational Health and Safety Model for autonomous teleworking, and to the structuring and validation of the Maturity of the Occupational Health and Safety Management System (EMA), Quality of Life (CoL), and Working Conditions (WC) instruments. For the development of the Model, the following categories were analyzed: advantages and disadvantages of teleworking, teleworking modalities, worker conditions, environmental conditions, conditions of the tasks, change management, leadership, and quality of life. Statistical validations were performed on each proposed instrument, such as internal consistency, factor analysis, and component analysis. In the proposed Model, the employer or contractor must address the prevention of accidents and occupational diseases and the protection and promotion of the health of workers and/or contractors through the implementation, maintenance, and continuous improvement of a management system with principles based on the PDCA cycle (Plan, Do, Check, and Act).


**Keywords:** Teleworking, telecommuting, Safety and Health at Work, occupational health, teleworker.


# RESUMEN

El Modelo de Gestión en Seguridad y Salud en el Trabajo para Teletrabajo autónomo se realizó bajo las directrices de la legislación aplicable a Colombia y la estructuración y validación de instrumentos: Madurez del Sistema de Gestión de Seguridad y Salud en el Trabajo (EMA-GSST), calidad de vida y condiciones de trabajo. Para el desarrollo del Modelo, se analizaron las siguientes categorías: ventajas y desventajas del teletrabajo, modalidades de teletrabajo, condiciones de los trabajadores, condiciones ambientales, condiciones de tareas, gestión del cambio, liderazgo y calidad de vida. Se realizaron validaciones estadísticas en cada instrumento propuesto, como consistencia interna, análisis factorial y análisis de componentes principales. En el Modelo propuesto, el empleador o el contratista deben abordar la prevención de accidentes y enfermedades profesionales, la protección y promoción de la salud de los trabajadores o contratistas, a través de la implementación, mantenimiento y mejora continua de un sistema de gestión cuyos principios se basan en el Ciclo PHVA (Planificar, Hacer, Verificar y Actuar).


**Palabras clave:** teletrabajo, teletrabajo, seguridad y salud en el trabajo, salud laboral y teletrabajador.


# RESUMO

Os resultados são determinados pelas orientações e regulamentos sobre saúde e segurança aplicáveis ao teletrabalho na Colômbia, a concepção do modelo de saúde e segurança no trabalho para o teletrabalho autônomo; e a estruturação e validação de instrumentos: Maturidade do Sistema de Gestão da Segurança e Saúde no Trabalho (EMA-GSST), qualidade de vida e condições de trabalho. Para o desenvolvimento do Modelo, foram analisadas as seguintes categorias: vantagens e desvantagens do teletrabalho, modalidades de teletrabalho, condições dos trabalhadores, condições ambientais, condições das tarefas, gestão da mudança, liderança e qualidade de vida. Foram efetuadas validações estatísticas sobre cada instrumento proposto, tais como consistência interna, análise fatorial e análise de componentes. No modelo proposto, o empregador ou empreiteiro deve tratar da prevenção de acidentes e doenças profissionais, da proteção e promoção da saúde dos trabalhadores e/ou empreiteiros, através da implementação, manutenção e melhoria contínua de um sistema de gestão cujos

princípios se baseiam no ciclo PHVA (do inglês Plan, Do, Check and Act). O instrumento de qualidade de vida foi customizado de modo a proporcionar, juntamente com outros modelos, uma ferramenta válida e fiável.

**Palavras-chave**: Teletrabalho, segurança e saúde no trabalho, saúde trabalhista e teletrabalhador.

# INTRODUCTION

Teleworking advantages as a work system are countless for both organizations and large capital cities, since the development of information and communication technologies (ICT) has made it possible to implement different business organization and management forms, thus helping to reduce commuting costs, optimize resources, exchange information and knowledge and, above all, recognize the capabilities and strengths of individuals as creators and autonomous beings, among other aspects (Vargas & Osma, 2013).

Other positive aspects are the worker welfare, labor flexibility, and a better balance between work and family commitments (Véliz Rojas, Valenzuela Suazo & Paravic Klijn, 2014). Telework can allow flexibility for people in several ways that can help improve their working life options (Raffaele & Connell, 2016). There are actually many advantages. On the other hand, there are some issues involving Occupational Safety and Health that must be reviewed accordingly, such as schedules and leaves, distribution of work equipment facilities, musculoskeletal problems associated with computer use, isolation and stress (Montreuil & Lippel, 2003). Little analysis has been conducted on the impact of working from home in the daily life organization and the changes in the domestic environment (Pérez Sánchez & Gálvez Mozo, 2009). Teleworkers have recognized mental fatigue at home as a source of stress (Hori & Ohashi, 2004), although stress at home, childcare, and teleworking imply a greater demand (Virick, Lilly & Casper, 2007). Boundaries between teleworking and home duties, social isolation from peers and the constant feeling of workplace detachment are blurred (Robertson, Schleifer & Huang, 2012).

Teleworkers report higher levels of job satisfaction but show a lower level of awareness and knowledge about ergonomics and safety issues (Von Bergen, 2008). Therefore, the support by the organization is relevant: security professionals should be involved in the development of equipment selection programs, in providing guidelines to teleworkers, and in establishing criteria for structuring the home office. It is important for companies to provide good equipment or, at a minimum, the guidance on what employees should buy to telework. Employees should configure their workstations ergonomically and safely (Ellison, 2011). Security managers must ensure that their companies have strategies to ensure the health and safety of this new class of workers (Topf, 2005). The occupational health task is to participate in the interdisciplinary work required by this phenomenon and implement in parallel this new form of work (Gareca, Verdugo, Briones & Vera, 2007).

Colombia has been a leading country in implementing teleworking. Documents have been prepared, like the '*Libro Blanco: el ABC del Teletrabajo en Colombia*' ('White Book: Fundaments of Teleworking in Colombia'), which is the first methodological approach aimed at planning and implementing labor models that take advantage of the ICT, and simultaneously provide organizations with various advantages that cover the organizational, productive, financial, technical, and balance areas between the work and personal life of employees (Ministerio de las Tecnologías de la Información y las Comunicaciones & Ministerio del Trabajo, 2016). The book presents guidelines for developing teleworking, although, in practice, several aspects are required for teleworking to meet Occupational Health and Safety standards (Decree 1072/2015 and ISO 45001:2018). However, according to

the literature review, in Colombia there are no occupational health and safety management models for autonomous teleworking.

The International Labor Organization (ILO) calls on specific aspects when implementing this work modality. The voluntary nature of teleworking (cannot be imposed); employment conditions (teleworkers have the same rights as comparable category workers in the workplace); data protection (the employer is responsible for taking precautions regarding data protection); the private life area (the employer must respect the workers' private life); equipment (typically, the employer is responsible for facilitating, installing and maintaining the necessary equipment for regular teleworking, except if the teleworker decides to use his/her own equipment); health and safety (the employer is responsible for teleworkers' health and safety); training and professional development (teleworkers have the same access to training and professional development opportunities as comparable category workers in the employer's premises); and collective rights (teleworkers have the same collective rights as comparable category workers in the employer's premises) (International Labour Office, 2018).

Autonomous teleworking in Colombia is the work system posing a great challenge for organizations, i.e. work as a team and permanently fostering participation at all cycle stages and managing work inherent risks that could affect the teleworker's health. All efforts must directly aim at protecting health, well-being, and balance of personal and work life of people working in a company in person or remotely (Cataño Ramírez & Gómez Rúa, 2014).

There are instances that can influence the implementation of the occupational safety and health management model from the organization point of view, such as discipline as a fundamental value, implemented and declared from the organizational purpose itself and impregnated in the corporate DNA (Contreras & Rojas, 2015). It becomes necessary to determine contractual aspects, companies' responsibilities, definition of working hours and times, health and safety conditions, surveillance, supervision, need to create specific training for the teleworker, and companies that have this work system implemented (Bonilla Prieto et al., 2014).

In Colombia, some studies have addressed teleworking from the quality of life standpoint. A study conducted in Popayán (Cauca) identified occupational safety and psychosocial risk conditions in workers performing as teleworkers in that city (Bonilla Prieto et al., 2014). In Bucaramanga, a study conducted in the footwear sector showed that in hiring teleworkers it is necessary to establish bonds of trust and develop skills that go beyond their computer skills. Entrepreneurs state that teleworkers must be responsible, creative, innovative, fulfill their duty, and develop skills related to communication, time management, and literacy to improve corporate competitiveness (Guzmán Duque & Abreo Villamizar, 2017). A study was carried out in Bogota to address the relevance of the diagnosis and proposal for the strengthening of the teleworking model aimed at continuous improvement at the EAN University (Valbuena & Anaya 2017).

It is urgent for companies to have methodologies and tools to practically and friendly guide the Occupational Health and Safety Assessment Series (OSHAS), in compliance with international standards, taking into account that it is a new issue posing many questions. That is why the occupational health and safety management model for autonomous teleworkers becomes an organizational strategy, since the company under study hired teleworkers to work from home and they have not been in the company's premises.

This article presents the outcomes of a research that aimed at developing an occupational safety and health management model for autonomous teleworking in Colombia, as well as the validation of three instruments that allow measuring such management maturity, work conditions, and the quality of work life of that population, in order to

provide Colombian organizations with valid guidelines and instruments to strengthen their daily management of an occupational safety and health (OSH) program.

# METHODS

For research purposes, a correlation scope with a quantitative approach was determined. Three instruments related to the categories set out in the research were selected for the construction of the model. The instruments are, namely: 1) Maturity of Management and Occupational Health and Safety EMA (Rodríguez Rojas & Pedraza Nájar, 2018). 2) Working conditions, adapted from the Déparis Guide (Malchaire, n.d.), and 3) Quality of Life, which is a CVT - GOSHISALO -based instrument (González Baltazar et al., 2010). The instruments used have prior construct validation processes. In this study, the level of reliability according to Cronbach's Alpha was 0.9744 for EMA, 0.903 for WC, and 0.9692 for CoL.

Once the instruments were reviewed, the questions were adapted to the autonomous teleworkers condition in Colombia, and a survey was designed on the virtual platform of the company under study. The three survey instruments were then sent to teleworkers by email, who answered them between October 1, 2018 and January 9, 2019. Once the information on the surveys carried out was available, each of the instruments was statistically tested to assess internal consistency, factor analysis, and principal component analysis. Then the correlation between the instruments applied was established. Finally, based on that information, the hypotheses raised were evaluated:

Hypothesis 1: Working conditions have a significant relation with the improvement of the teleworker's quality of life.

Hypothesis 2: Working conditions have a significant relation with the improvement of the maturity of the OSHAS.

Hypothesis 3: The OSHAS maturity have a significant relation with the improvement of the teleworker's quality of life.

The following methodologies were used for the validation of instruments:

Internal consistency: Cronbach's alpha was used to measure each instrument's internal consistency. This measure seeks to prove the assumption that the different items measure the same theoretical dimension of the Maturity Level of Occupational Health and Safety System Management (ML of OSHAS) and that those items have a high correlation with each other.

The instrument validity is understood as the degree to which said instrument is capable of measuring what it is desired to measure. The Alpha value can range from 0 to 1, and values close to 1 are the desirable values, which indicate greater internal consistency. Good or excellent internal consistency means that the items making up the questionnaire can effectively be used to measure the variable of interest. In the work under analysis, an instrument is composed of a set of items that can be grouped into dimensions (Factors), so that one dimension will be made up of some highly correlated items. The methodology followed for each instrument was:

1. Descriptive evaluation of items general correlation based on the correlation matrix. It is desirable to observe high positive correlations.
2. Descriptive evaluation of items correlation by theoretical dimension (Factor) based on the correlation matrix. It is desirable to observe high positive correlations.
3. Cronbach's Alpha calculation to formally complete the descriptive analysis.

Factor analysis: since based on the theoretical knowledge defined dimensions are supposed to be correct, it is necessary to corroborate whether the use of factors or dimensions is appropriate due to the variability (variance)

shown by the different items within an instrument. It is necessary to clarify that the use of factors has proven to be adequate. However, it is not proven whether the factors chosen are suitable, since this would imply the use of a confirmatory factor analysis that has not been considered in this research. The previous verification can be conducted based on some indicators and statistical tests. Two tools were used, namely: 1. Bartlett's sphericity coefficient, 2. Kaiser-Meyer-Olkin - KMO index.

Main component analysis: It was performed to define each item's weight or weighting and each dimension by explaining the total variability of the OSH maturity level. The main objective of the main components analysis is the reduction of dimensionality, i.e., a large set of variables (items) needs to be reduced to a smaller number with the minimum loss of information. That is, explain variability with a smaller number of variables. These new variables are artificial (called main components) and are formed as a linear combination of the original variables. Therefore, the magnitude (absolute value) of the constants associated with each original variable in the linear combination can be interpreted as the importance of that original variable to explain the total variability, taking into account that all the items have the same scale of measure.

Analysis of correlations between instruments: After defining the weights of each item in each instrument, a rating per person per instrument was assigned, thus generating 77 observations per instrument. Then a correlation analysis among results obtained by each instrument was performed.

Surveys were sent to 160 officials, who were hired as autonomous teleworkers and served as the study population; 77 people answered the surveys, corresponding to 95% confidence, taking into account that the population was 160 teleworkers when the study was conducted. The statistical analysis was carried out with the free software RStudio.

# RESULTS AND DISCUSSION

The occupational health and safety management model for autonomous teleworkers was developed. Such model has different categories directly related to the teleworker, and the purpose is to manage OSH from the promotion and prevention perspective for teleworkers.

The principles of the teleworking OSH management aim at organizational conditions and person's conditions, some of which apply concomitantly.

Worker Conditions

Self-management: The worker must be highly committed and be the OSH self-manager in his/her environment. Self-management is a key element of OSH management (Topf, 2005). The worker must plan, do, check, and act based on his/her competence. He/she must be convinced that the safety and health at work depends on his/her management in that area. Therefore, self-reports, hazard identification, implementation of controls, and effectiveness verification thereof depends on him/her (Bustos, 2012; Ministerio de las Tecnologías de la Información y las Comunicaciones & Ministerio del Trabajo, 2016; Topf, 2005).

Discipline: High commitment with the task and results are required from the teleworker, who must have the discipline to be able to work without supervision, which in terms of OSH means to make healthy breaks, work ergonomically, follow principles of order and cleanliness, and have a healthy lifestyle without direct supervision (Bajzikova et al., 2016; Montreuil & Lippel, 2003).

## Organizational Conditions

Leadership: Leadership must cover all levels, i.e., company strategic (senior management), tactics (supervisors, managers, managing positions), and operational components (workers). The leadership must address the causes of unsafe behaviors. The teleworker is his own leader

and therefore must be responsible for his own health (Bustos, 2012; Topf, 2005).

Leadership and commitment, including awareness, responsiveness, active support and feedback from senior management of the organization are paramount to the OSH management system success and to the achievement of the expected results thereof. Therefore, senior management has specific responsibilities for which it needs to be personally involved or needs to lead.

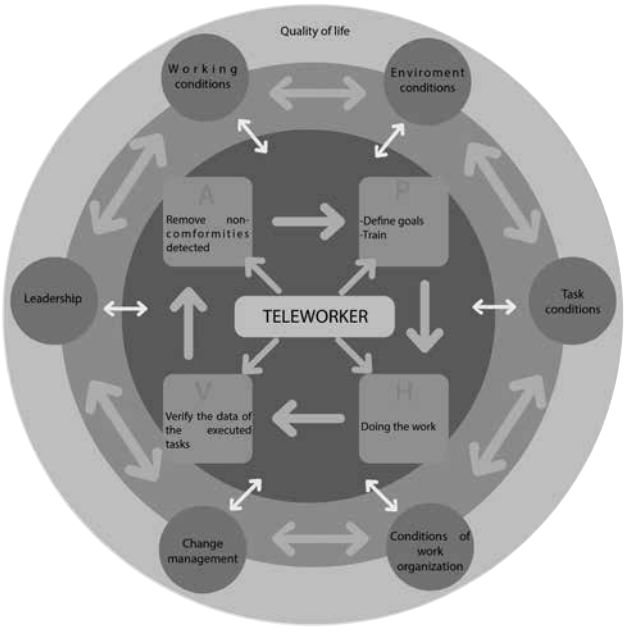
Senior management largely determines the culture that supports an organization's OSH management system and such culture results from values, attitudes, perceptions, competencies, and individual and group behavior models that determine the commitment to its OSH management system, its style, and its aptitude. It is characterized by, but not limited to, the active participation of workers, mutual trust-based cooperation and communications, shared perceptions of the importance of the OSH management system through active involvement in the detection of opportunities for OSH, and confidence in the effectiveness of preventive and protective measures. An important way for senior management to demonstrate their leadership is encouraging workers to report incidents, dangers, risks and opportunities, and to protect workers from retaliation such as threats of dismissal or disciplinary actions, if they do so (Instituto Colombiano de Normas Técnicas y Certificación, 2018).

Risk Based Thinking: It must address the risks and opportunities in OSH and in the OSHA system (Instituto Colombiano de Normas Técnicas y Certificación, 2018).

Change management: Teleworkers can better protect themselves by thinking themselves as their own occupational health and safety manager. The key is to change behaviors by addressing the consequences, attitudes, beliefs, and contractual circumstances (Topf, 2005). Teleworking is a new way of working, so addressing OSH risks requires changes in the teleworker behavior and in the organizational culture. Organizations are constantly evolving, so to implement the model, a change in the management process must be concomitantly implemented at all levels.

The model scheme is shown below:

**Figure 1.** Model of occupational safety and health management for autonomous telework in Colombia.




Source: own preparation.

To structure the model, three instruments were analyzed: OSHAS (EMA) maturity scale, working conditions (WC) and Quality of Life (CoL):

EMA: The instrument is composed of 24 items that seek to measure the theoretical dimension of Level of "Maturity of the Occupational Health and Safety Management System" (ML of OSHAS). The 24 items are classified in 10 dimensions with the same scale so for their analysis data standardization was not necessary.

**Table 1**. Composition of EMA instrument dimensions

| # | Dimension | Subdimension | Nomenclature |
|---|---|---|---|
| 1 | Strategic position | Strategic posture | EMA5A1 |
| | | | EMA5A2 |
| 2 | OSHA Organizational learning | OSH stakeholders learning | EMA10A3 |
| 3 | OSHA integration into the organization | Continuous improvement | EMA6A4 |
| | | Integration | EMA6B5 |
| 4 | Strategic planning | Exchange direction | EMA8A6 |
| 5 | Capacity planning | Communication internal structure | EMA9A7 |
| 6 | OSHA evaluation | OSH decisions making based on indicators | EMA7A8 |
| | | OSHA Performance | EMA7B9 |
| | | | EMA7B10 |
| 7 | Participation and communication | Participation | EMA4A11 |
| | | | EMA4A12 |
| | | Communication | EMA4B13 |
| | | Quality of life at work | EMA4C14 |
| 8 | Legal aspects | Environment requirements | EMA3A16 |
| | | | EMA3A17 |
| 9 | OSH Policy | Policy guidance in OSH | EMA1A19 |
| | | | EMA1A20 |
| | | | EMA1A21 |
| | | | EMA1A22 |
| 10 | Strategic analysis | Innovation in OSH management | EMA2C23 |
| | | | EMA2C24 |
| | | Quality of life at work | EMA2A15 |
| | | Technical measures | EMA2B18 |

Source: own elaboration based on (Rodriguez et al., 2017)

WC: The instrument is composed of 18 items that seek to measure the theoretical dimension (ML of OSHAS). These 18 items have been measured with the same scale, so for its analysis data standardization was not necessary. These items are classified in three large dimensions that group several items:

**Table 2.** WC instrument dimensions

| Cod_Dim | Dimensions | Cod_Sub | Subdimensions | #Items |
|---|---|---|---|---|
| 1 | Environment conditions | A | Chemical contaminants | 1 |
| 1 | Environment conditions | B | Physical contaminants | 5 |
| 1 | Environment conditions | C | Safety conditions | 1 |
| 2 | Task conditions | A | Physical load | 3 |
| 2 | Task conditions | B | Cognitive load | 2 |
| 3 | Conditions of work organization | A | Organization structure | 1 |
| 3 | Conditions of work organization | B | Organization of working time | 2 |
| 3 | Conditions of work organization | C | Job position characteristics | 3 |

Source: own elaboration based on (Profesor J. Malchaire et al., 2007)

CoL: The instrument is composed of 74 items that seek to measure the theoretical dimension (ML of OSHAS). These 74 items have been measured with the same scale, so for its analysis data standardization was not necessary. These items were classified in 7 dimensions according to their purpose:

**Table 3.** CoL dimensions

| Cod_Dim | Dimensions | Cod_Sub | Subdimensions | #Items |
|---|---|---|---|---|
| 1 | Institutional support for work | A | Labor processes | 2 |
| 1 | Institutional support for work | B | Work supervision | 2 |
| 1 | Institutional support for work | C | Supervisors support to carry out the work | 7 |
| 1 | Institutional support for work | D | Work evaluation | 1 |
| 1 | Institutional support for work | E | Promotion Opportunities | 1 |
| 1 | Institutional support for work | F | Autonomy | 1 |
| 2 | Safety at work | A | Work procedures | 1 |
| 2 | Safety at work | B | Income or salaries | 3 |
| 2 | Safety at work | C | Work inputs | 2 |
| 2 | Safety at work | D | Contractual rights of workers | 6 |
| 2 | Safety at work | E | Job Training | 3 |
| 3 | Job integration | A | Relevance | 2 |
| 3 | Job integration | B | Motivation | 3 |
| 3 | Job integration | C | Work environment | 5 |
| 4 | Job Satisfaction | A | Dedication to work | 4 |
| 4 | Job Satisfaction | B | Pride for the institution | 1 |
| 4 | Job Satisfaction | C | Job participation | 2 |
| 4 | Job Satisfaction | D | Autonomy | 2 |
| 4 | Job Satisfaction | E | Recognition for work | 1 |

Continúa

| Cod_Dim | Dimensions | Cod_Sub | Subdimensions | #Items |
|---|---|---|---|---|
| 4 | Job Satisfaction | F | Self-assessment | 1 |
| 5 | Well-being achieved through work | A | Identification with the institution | 2 |
| 5 | Well-being achieved through work | B | Work benefits for others | 1 |
| 5 | Well-being achieved through work | C | Enjoyment of work activity | 2 |
| 5 | Well-being achieved through work | D | Housing Satisfaction | 2 |
| 5 | Well-being achieved through work | E | General Health Evaluation | 2 |
| 5 | Well-being achieved through work | F | Nutrition evaluation | 2 |
| 6 | Personal development | A | Achievements | 4 |
| 6 | Personal development | B | Improvement Expectations | 2 |
| 6 | Personal development | C | Personal safety | 2 |
| 7 | Free time administration | A | Free time planning | 2 |
| 7 | Free time administration | B | Balance between work and family life. | 3 |

Source: own elaboration based on (Gonzalez et al., 2010)

The maturity model concept originated in organizational quality models and software industry models. They were created for organizations to understand their own level of maturity in security management, by assessing the level of compliance with the various key elements of the safety culture (Rodriguez-Rojas, Pedraza-Nájar & Martínez Arroyo, 2017). For the research, the maturity instrument of occupational health and safety management was adapted to teleworking (Rodríguez Rojas & Pedraza Nájar, 2018).

For EMA instrument validation, the following steps were carried out:

**Table 4.** *Findings of the EMA instrument validation process*

| Step | Description | Analysis Performed | Finding | Interpretation |
|---|---|---|---|---|
| 1 | Instrument internal consistency | General items correlation based on the correlation matrix. | The items have high positive correlations with an average of 0.6132. | Observed correlations greater than 0.5, which is an indication that those items are adequate to measure the variable of interest as a whole (ML of OSHAS). |
| | | Cronbach's alpha | 0.9744 >0.9 | Excellent, therefore, the selected items are suitable to measure the theoretical variable, which enables the subsequent analysis. |
| 2 | Factor analysis | Bartlett's sphericity test. | Chi-square: 3014.51<br>Degrees of freedom: 276.00<br>P = 0 | Since p < 0.05, it can be concluded that there is at least one correlation between items other than zero. Therefore, the use of a factor analysis (dimensions) is suitable for the items' analysis. |
| | | Kaiser-Meyer-Olkin - KMO index (indicator). | 0.89 | This KMO is close to 1 (> = 0.75) and, as per the criteria, it is good to perform the factor analysis. Therefore, based on this indicator, it can also be concluded that the use of dimensions is suitable for the items' analysis. |

Continúa

| Step | Description | Analysis Performed | Finding | Interpretation |
|---|---|---|---|---|
| 3 | Main component analysis | Factor weights | | Three components meet the condition of the Kaiser criterion (OSH Policy; Strategic Analysis and Participation and Communication); however, in the search to maintain maximum information reliability, the fourth component with 0.99% variability is included. |
| | | Component equation | The equation of main components was constructed with the new dimensions and can be used later for forecasts determination with the results obtained. | |

Source: own preparation.

To validate the WC instrument, the following steps were performed:

**Table 5.** Findings of the WC instrument validation process

| Step | Description | Analysis performed | Finding | Interpretation |
|---|---|---|---|---|
| 1 | Instrument internal consistency | General items correlation based on the correlation matrix. | Correlations average is 0.3412 | Positive correlations are evident, although they are not very close to 1. Relatively moderate value, so it is not possible to suspect if the instrument is valid based on the descriptive analysis. Therefore, evaluation with other methods were necessary to reach a conclusion. |
| | | Cronbach's alpha | 0,903 >0.9 | Internal consistency is excellent, so the selected items are suitable to measure the theoretical variable, which enables the subsequent analysis. |
| 2 | Factor analysis | Bartlett's sphericity test | Chi-square: 882.9238<br>Degrees of freedom: 153<br>P = 0 | P < 0.05, then it can be concluded that there is at least one correlation between items other than zero; therefore, the use of a factor analysis (dimensions) is suitable for the items' analysis. |
| | | Kaiser-Meyer-Olkin - KMO index (indicator) | 0.73 | (0.5<=KMO<=0.75) means that it is acceptable to use the factor analysis, therefore, based on this indicator it was also concluded that the use of dimensions is suitable for the items' analysis. |
| 3 | Main component analysis | Factor weights | | The factor composition is established by finding that six components meet the Kaiser criterion condition, thus constructing the matrix and the final components. |
| | | Component equation | The equation of main components was constructed with the new dimensions and can be used later for forecasts determination with the results obtained. | |

Source: own preparation.

To validate the CoL instrument, the following steps were performed:

**Table 6.** Findings of the CoL instrument validation process

| Step | Description | Analysis performed | Finding | Interpretation |
|---|---|---|---|---|
| 1 | Instrument internal consistency | General items correlation based on the correlation matrix. | Descriptive evaluation of items general correlation based on the correlation matrix. It is desirable to observe high positive correlations. Since there are 2701 correlations in total, only a total of 97 negatives corresponding to 3.59% of the total were found. | There are no high correlations and even negative correlations can be observed, which in general are not desirable in this context. The correlations average is 0.2986, a relatively low value, therefore, based on the descriptive analysis it was not possible to determine whether the instrument is valid, so evaluations with the other methods were necessary to reach a conclusion. |
| | | Cronbach's alpha | (0.9692 >0.9) | Internal consistency is excellent (0.9692 >0.9), therefore, the selected items are suitable to measure the theoretical variable, which enables the subsequent analysis. |
| 2 | Factor analysis | Bartlett's sphericity test | Chi-square: 9992.27<br>Degrees of freedom: 2701.00<br>P = 0 | Since $p < 0.05$, it can be concluded that there is at least one correlation between items other than zero, therefore, the use of a factor analysis (dimensions) is suitable for the items' analysis. |
| | | Kaiser-Meyer-Olkin - KMO index (indicator) | 0.25 (initial)<br>0.47 (upon recalculation) | This KMO is close to 0, according to this indicator the correlations magnitudes do not require using factors or dimensions. However, in this case, we proceed by evaluating which items show a more frequent negative correlation with the other items and then we will remove them from the instrument, thus trying to improve the KMO indicator. |
| 3 | Main component analysis | Factor weights | 16 components were found to meet the Kaiser criterion condition, thereby constructing the matrix of main components and the corresponding equation. | |
| | | Component equation | The equation of main components was constructed with the new dimensions and can be used later for forecasts determination with the results obtained. | |

Source: own preparation.

When finding a very low KMO, an analysis was carried out that showed that the proposed items to be eliminated were:

CV2D61. with 8 negative correlations

CV1C49, with 6 negative correlations

CV1B28, with 4 negative correlations

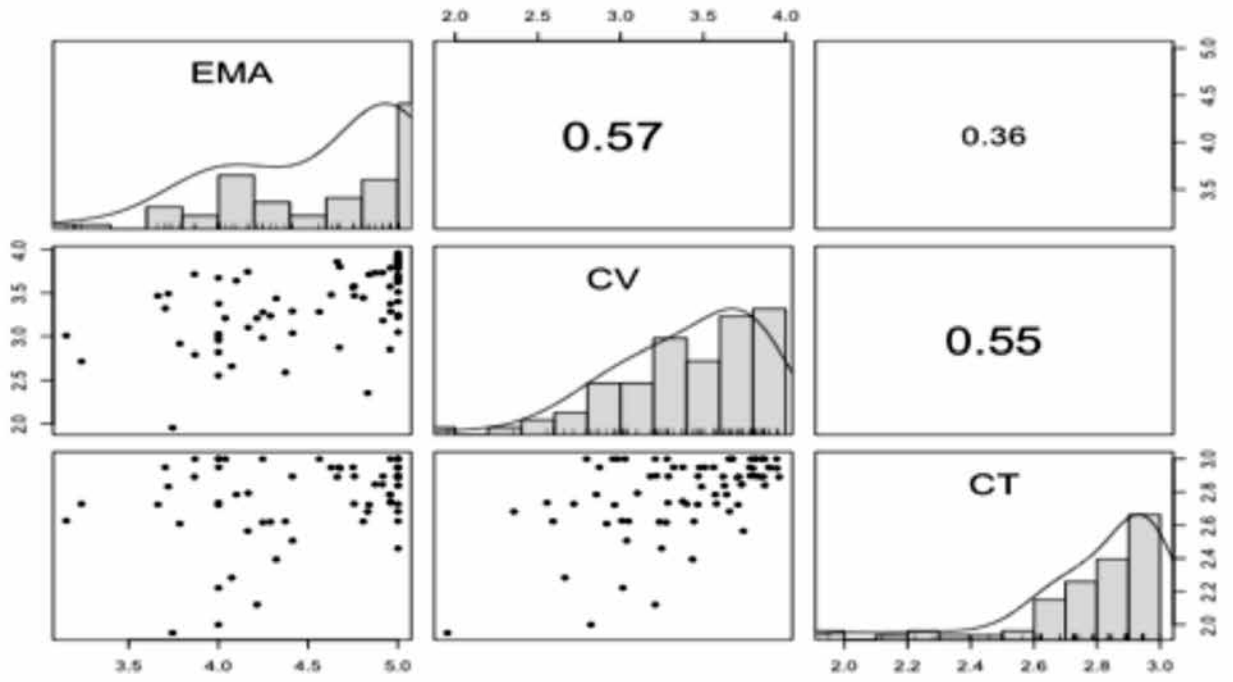
CV1B6, with 4 negative correlations

CV2B8, with 4 negative correlations

CV2E33, with 4 negative correlations

With this change, the KMO is recalculated and the result is 0.47. A considerable improvement was observed in this indicator and by removing the items the conclusions of the previous analyzes do not change significantly. Therefore, the new instrument is made up of 68 items, dimensions 1 were modified removing 3 items and dimensions 2 removing 3 items., All subsequent analyzes will be performed with this modified instrument. Then the correlational analyzes between instruments were performed,

**Figure 2.** Correlation between instruments




Source: Statistical analysis

When observing the correlation between instruments, it is observed that EMA has a moderately high positive correlation. However, the correlation with the WC instrument is lower. The CoL instrument has a moderately high positive correlation with both EMA and WC.

Taking into account that there are correlations that, although not very large, are not negligible, it is important to describe the scores obtained by the CoL instrument based on the scores obtained by the EMA and WC instruments. A multiple linear regression analysis was performed, and the following regression equation was obtained:

Where the intercept proved to have no statistical significance, on the other hand, the regression coefficients for EMA and WC proved to be statistically significant at a 95% confidence. The criterion used is the p-value, where $p < 0.05$ indicates statistical significance of the regression coefficient. The reported p-values are shown in Table 7:

**Table 7.** Components of correlation between instruments

| Coefficient | P-value | Conclusion |
|---|---|---|
| Intercept | 0,557 | Not significant |
| EMA | 1.06X10^(-5) | Significant |
| WC | 6.05X10^(-5) | Significant |

Source: Statistical analysis

From these results, the regression equation can be reduced as follows:

However, this model generates an R^2 of 0.4615, which indicates that the model is only able to explain 46.15% of the total CoL variability. Therefore, it is not a good model to predict and it allows concluding that EMA and WC alone cannot explain a sufficient total variability. This indicates that there are other explanatory variables that were not taken into account and this point can be used in future research.

In Colombia, teleworking is a formal work option that aims at improving people's quality of life. The model proposes to involve the following conditions: work, environment, task, organizations, change management, and leadership conditions. Colombian studies on teleworking prioritize factors such as establishing bonds of trust and developing skills that go beyond the worker computer skills (López-Medina, Mosquera-Angulo & Nieto-Gómez, 2014). Responsibility, creativity, innovation, and development of communication skills, time management and literacy improve business competitiveness (Guzmán Duque & Abreo Villamizar, 2017).

Teleworking implies many benefits (costs reductions, time savings by avoiding commuting, and it is a factor of change to improve people's quality of life). It is a new work option, which has several aspects still to be researched, a field where companies must have simple tools that allow the OSHAS implementation and monitoring under international standards. The occupational health and safety management model for autonomous teleworkers shows up as an organizational strategy, which will help organizations and teleworkers in the development of their tasks. It is necessary to further research other forms of teleworking in order to determine adaptations to the instruments and the model developed.

# CONCLUSIONS

The Occupational Health and Safety Management Model for autonomous teleworkers is a starting point for developing useful methodologies for companies that are implementing teleworking and the OSHAS, and that are in the process of implementing the ISO 45001/2018 and simply and systematically generating processes to support leaders of the Occupational Health and Safety processes. It is necessary to continue implementing the model in other types of teleworking and establish whether this model can be adapted to those groups. Since the instruments are statistically validated, there is a reliable tool for companies that wish to implement this model, which, although developed on a platform of the company under study, can be easily adapted through virtual media, by customizing the responses.

The instruments used (Maturity of the Occupational Health and Safety Management System (EMA), Working Conditions (WC), and Quality of Life (CoL)) were taken from instruments already developed and used in other researches. The adaptation consisted on modifying them to focus on some teleworkers aspects, taking into account that this is a work system where the teleworker is part of a company but performs his/her work in a place other than the company's premises. This approach seeks for the instruments to be tools based on the teleworker's daily life.

The EMA and WC instruments, as they are designed, are reliable elements to be used in the evaluation of aspects of the Occupational Health and Safety System for Teleworkers,

while the Quality of Life at work instrument statistically requires eliminating some questions that generate low or no correlations. Independently, each of the instruments is a good tool to detect conditions; however, when grouped together, correlations are not so high.

The tendency of autonomous teleworking is to generate virtual spaces in their entirety, a situation that must be reviewed, so that they alternate with face-to-face encounters in the work centers, and at the same time are monitored through instruments and follow-ups specific to teleworkers.

# REFERENCES


Bajzikova, L., Sajgalikova, H., Wojcak, E. and Polakova, M. (2016). How Far is Contract and Employee Telework Implemented in SMEs and Large Enterprises? (Case of Slovakia). *Procedia - Social and Behavioral Sciences*, *235*, 420-426. https://doi.org/10.1016/j.sbspro.2016.11.052

Bonilla Prieto, L., Plaza Rocha, D., De Cerquera, G. and Riaño-Casallas, M. (2014). Teletrabajo y su Relación con la Seguridad y Salud en el Trabajo. *Ciencia & trabajo*, 16(49), 38-42. https://doi.org/10.4067/S0718-24492014000100007

Bustos, D. (2012). Sobre subjetividad y (tele)trabajo. Una revisión crítica. *Revista de Estudios Sociales*, *44*(diciembre), 181-196. https://doi.org/10.7440/res44.2012.17

Cataño Ramírez, S., & Gómez Rúa, N. (2014). El concepto de teletrabajo: aspectos para la seguridad y salud en el empleo. *CES Salud Pública*, *5*(1), 82-91. Available at: http://revistas.ces.edu.co/index.php/ces_salud_publica/article/view/2772/2180

Contreras, O., & Rojas, I. (2015). Teletrabajo y sostenibilidad empresarial. Una reflexión desde la gerencia del talento humano en Colombia. *Suma De Negocios*, *6*(13), 74-83. doi: https://doi.org/10.1016/j.sumneg.2015.08.006

Ellison, J. K. (2011, January 1). Ergonomics for Telecommuters and Other Remote Workers. American Society of Safety Engineers. Available at: https://www.onepetro.org/conference-paper/ASSE-11-557

Gareca, M., Verdugo, R., Briones, J., & Vera, A. (2007). Salud Ocupacional y Teletrabajo. *Ciencia & Trabajo*, *25*(July-September), 85-88. Available at: http://www.sigweb.cl/wp-content/uploads/biblioteca/TeletrabajoACHS.pdf

González Baltazar, R., Aranda Beltrán, C., Elizalde Núñez, F. and Pando Moreno, M. (2010). Elaboración y Validación del Instrumento para Medir Calidad de Vida en el Trabajo "CVT-GOHISALO". *Ciencia & Trabajo*, [online] *36* (April-June), 332-340. Available at: http://file:///C:/Users/ingcr/Downloads/fulltext_stamped.pdf.

Guzmán Duque, A. and Abreo Villamizar, C. (2017). Las habilidades del teletrabajador para la competitividad. *Fórum Empresarial*, *22*(2), 5-30. https://doi.org/10.33801/fe.v22i2.13624

Hori, M., & Ohashi, M. (2004). Teleworking and mental health - collaborative work to maintain and manage the mental health for women's teleworkers. *Proceedings Of The 37Th Annual Hawaii International Conference On System Sciences*. doi: https://doi.org/10.1109/hicss.2004.1265386

Instituto Colombiano de Normas Técnicas y Certificación (2018). *NTC ISO 45001:2018. Sistema de Gestión de Seguridad y Salud en el trabajo*. Bogota: Instituto Colombiano de Normas Técnicas y Certificación.

International Labour Office. (2018). Conferencia Internacional del Trabajo 107.ª reunión 2018. Garantizar

un tiempo de trabajo decente para el futuro International Labour Office. Available at: https://www.ilo.org/ilc/ILCSessions/previous-sessions/107/lang--es/index.htm

López-Medina, R., Mosquera-Angulo, H. and Nieto-Gómez, L. (2014). Condiciones de seguridad y salud laboral identificadas en trabajadores bajo la modalidad de teletrabajo en Popayán, Cauca, Colombia. Libre Empresa, 11(2), 21-39. https://doi.org/10.18041/1657-2815/libreempresa.2014v11n2.3023

Malchaire, J. (n.d.). *Diagnóstico participativo de riesgos profesionales en una situación de trabajo método DÉPARIS*. Bélgica: Universidad Católica de Lovaina.

Ministerio de las Tecnologías de la Información y las Comunicaciones & Ministerio del Trabajo. (2016). *Libro blanco ABC del teletrabajo en Colombia*. Colombia.

Montreuil, S. & Lippel, K. (2003). Telework and occupational health: a Quebec empirical study and regulatory implications. *Safety Science*, *41*(4), 339-358. https://doi.org/10.1016/S0925-7535(02)00042-5

Pérez Sánchez, C., & Gálvez Mozo, A. (2009). Telework and daily life: Its pros and cons for work-life balance. *Athenea Digital. Revista De Pensamiento E Investigación Social*, *15*, 57-79. https://doi.org/10.5565/rev/athenead/v0n15.597

Raffaele, C., & Connell, J. (2016). Telecommuting and Co-Working Communities: What Are the Implications for Individual and Organizational Flexibility? En J. Sushil, J. Burgess (Eds), *Flexible Work Organizations* (pp. 21-35). India: Springer, New Delhi. https://doi.org/10.1007/978-81-322-2834-9_2

Robertson, M., Schleifer, L., & Huang, Y. (2012). Examining the macroergonomics and safety factors among teleworkers: Development of a conceptual model. *Work*, *41*, 2611-2615. https://doi.org/10.3233/WOR-2012-1029-2611

Rodríguez-Rojas, Y., Pedraza-Nájar, X. and Martínez, J. (2017). Evaluación de la madurez de la gestión de la seguridad y salud en el trabajo: revisión de literatura. *SIGNOS - Investigación en sistemas de gestión*, *9*(1), 113-127. https://doi.org/10.15332/s2145-1389.2017.0001.08

Rodríguez-Rojas, Y.L. y Pedraza-Nájar, X.L. (2018). Madurez de la gestión de la seguridad y salud en el trabajo. Revista Opción, 34(18), 1358-1389. Available at: https://produccioncientificaluz.org/index.php/opcion/article/view/23979/24424

Topf, M. (2005). The Alternative Work Force: Safety Challenges When Employees Work Remotely. Available at: https://www.ehstoday.com/safety/article/21908349/the-alternative-work-force-safety-challenges-when-employees-work-remotely. https://doi.org/10.17104/1863-8937-2016-4-114

Valbuena, S. R. & Anaya, L. C. (2017). *Análisis situacional y propuesta para el fortalecimiento del modelo de teletrabajo orientado a la mejora continua en la Universidad EAN*. Available at: http://hdl.handle.net/10882/8941

Véliz-Rojas, L., Valenzuela, S., & Paravic, K. (2014). Trabajos Atípicos en Chile: Un Desafío para la Salud Laboral y la Enfermería del Trabajo. *Ciencia & Trabajo*, *16*(49), 17-20. https://doi.org/10.4067/S0718-24492014000100004

Virick, M., Lilly, J., & Casper, W. (2007). Doing more with less. *Career Development International*, *12*(5), 463-480. https://doi.org/10.1108/13620430710773772

Von Bergen, C. W. (2008). Safety and workers' compensation considerations in telework. Regional Business Review, 131-150. Available at https://doaj.org/article/a87346107b9540fcb1534b402c243c9