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Mental health assessment using Power BI: Development and application of a dashboard for companies

Evaluación de salud mental mediante Power BI: Desarrollo y aplicación de un tablero para empresas

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ABSTRACT

This study focused on the creation and application of a mental health dashboard using Microsoft Power BI and the DASS-21 scale to assess levels of stress, anxiety, and depression in two companies: a productive one and a service one. The implemented methodology comprised three main phases: the creation of Google Forms to collect data, the execution of the ETL process in


Power BI, and the configuration of the dashboard. The results showed that the levels of stress, anxiety, and depression in both organizations were mostly within normal parameters. However, specific working areas and employees with critical levels of these disorders were identified, providing each company with the information necessary to take appropriate measures. The analysis by working areas revealed significant differences between departments, highlighting the importance of adapting wellness strategies to the specific needs of each section. The use of the Power BI dashboard proved to be an effective tool not only for general monitoring but also for the precise identification of risk areas and the application of preventive and corrective measures.

Keywords: power bi, business intelligence, mental health, dashboard analysis

RESUMEN

Este estudio se centró en la creación y aplicación de un tablero de salud mental utilizando Microsoft Power BI y la escala DASS-21 para evaluar los niveles de estrés, ansiedad y depresión en dos empresas: una productiva y otra de servicios. La metodología implementada constó de tres fases principales: la creación de Google Forms para la recolección de datos, la ejecución del proceso ETL en Power BI y la configuración del tablero. Los resultados mostraron que los niveles de estrés, ansiedad y depresión en ambas organizaciones se encontraban en su mayoría dentro de los parámetros normales. Sin embargo, se identificaron áreas de trabajo específicas y empleados con niveles críticos de estos trastornos, proporcionando a cada empresa la información necesaria para tomar las medidas adecuadas. El análisis por áreas de trabajo reveló diferencias significativas entre departamentos, destacando la importancia de adaptar las estrategias de bienestar a las necesidades específicas de cada sección. El uso del tablero control de Power BI demostró ser una herramienta eficaz no solo para el seguimiento general sino también para la identificación precisa de áreas de riesgo y la aplicación de medidas preventivas y correctivas.

Palabras clave: power bi, inteligencia de negocios, salud mental, análisis tablero control

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INTRODUCTION

Society currently lives in a work environment that is deeply influenced by Industry 4.0 technologies, such as the Internet of Things (IoT), automated production and artificial Intelligence (González Hernández et al., 2021). Furthermore, Joyanes Aguilar (2019) highlights the importance of Business Intelligence=BI, which encompasses a set of tools capable of accessing and analyzing data, offering summaries, maps and dashboards to provide detailed information for timely, informed decisions, efficiency, and competitive advantage. This technological environment imposes on employees the need to adopt an open mindset where it is essential that they can adapt to the changing demands of their organizations and carry out their responsibilities successfully. However, it is important to highlight that, on many occasions, a crucial aspect is overlooked: the impact on the mental health of employees, a concern that is not always part of the organizational culture of companies.

According to the Organización Mundial de la Salud (2022), approximately 60% of the world's population is employed, and it is essential that all employees enjoy the right to work in a safe and healthy work environment. It should be noted that poor work spaces often lead to discrimination and inequality, as well as excessive working hours, lack of control at work and job insecurity that result in a mental health risk. In 2019, 15% of working age adults were found to experience a mental health disorder globally, and it is estimated that 12 billion days of work are lost annually due to depression and anxiety, at a rate cost of \$1 billion USD per year in terms of productivity.

On the stress side, the consulting company Gall up Inc., found that the perceived work stress by geographical area worldwide in workers is as follows: East Asia 55%, United States and Canada 50%, Latin America and the Caribbean 50%, Australia and New Zealand 47%, Middle East and North Africa 45%, Europe 39%, Sub-Saharan Africa 39%, South Asia 35%, Southeast Asia 31%, and Commonwealth of Independent States 19 % (Inc, 2022). Mexico is the country with the highest work stress with a value of 75%, followed by China 73% and the United States 59% (Organización Internacional del Trabajo, 2016).

In terms of health and safety, Mexico is regulated by the Federal Labor Law and Official Mexican Standards. The NOM-035-STPS-2018 “Psychosocial risk factors at work-Identification, analysis and prevention” contemplates those severe traumatic events as well as psychosocial risk factors that can trigger the onset of a mental health disorder, in addition to 04 December 2023, an update regarding the Table of Occupational Illnesses was already published in the Diario Oficial de la Federación, which includes in group IV mental disorders such as: anxiety, non organic sleep-wake cycle disorders, and disorders associated with stress and depression (Diario Oficial de la Federación, 2023).

As a result of the indicated statistics and in compliance with the regulatory framework for safety and health at work, the timely detection of stress, depression and anxiety plays a crucial role in the organizational field to mitigate the following problems: stress has a great potential for impact work performance, as well as the ability to carry out activities, symptoms such as loss in performance, physical and mental exhaustion (Delgado Espinoza et al., 2020; Velazquez Fuentes, 2022); Depression influences family dysfunction, job performance, premature abandonment or withdrawal from the workplace, labor conflicts, decreased performance, increase in work accidents, indecision, forgetfulness, concentration and effectiveness (Castellón Leal et al., 2016; Mingote Adán et al., 2009; Yuan-Pang, 2017); and anxiety triggers irritability or frustration, feeling overwhelmed when tackling tasks, missing deadlines, lack of concentration, excessive worry that affects personal life, repetitive work-related thoughts, inappropriate responses to work comments, and focusing on negative aspects (Vige, 2024)

Considering the problems arising from mental disorders, this study focused on the creation and implementation of a mental health dashboard using Microsoft Power BI software and the DASS-21 psychological scale (Depression, Anxiety, and Stress Scale) to evaluate the levels of stress, anxiety, and depression among employees in organizations.

MATERIALS AND METHODS

Research design

The design of this study was non experimental, as the variables were not intentionally manipulated but observed as they naturally occurred in their context. Additionally, a cross-sectional approach was employed, as data was collected at a single point in time, allowing the evaluation of stress, anxiety, and depression levels at a specific moment within the participating organizations.

Instrument

Rating scales such as the Beck Inventory focus on somatic symptoms, but over time it was recognized that non-somatic symptoms are equally relevant to depression, anxiety and stress, this led to the development of the Depression Scales. Anxiety and Stress (DASS) by Lovibond and Lovibond to measure these three negative emotional states, including non-somatic symptoms. The DASS anxiety scale highlights symptoms related to fear, including situational anxiety and generalized anxiety, while stress is differentiated from depression and anxiety, but may be related to them due to the persistent response to stressors that it can give. This leads to maladaptive behaviors that overlap with depression and anxiety (Medvedev, 2023).

The Depression, Anxiety and Stress Scale (DASS) was developed by Australian psychologists Peter Lovibond and Stephen Lovibond, this scale has been widely used in the assessment of depression, anxiety and stress levels in the general and clinical population. Initially, the DASS scale consisted of 42 items (14 items for each subscale measuring depression and

anxiety), however, the results of tests carried out between 1979 and 1990, together with a factor analysis, revealed the existence of a third factor stress. It was suggested that this third factor could be shared between anxiety and depression, but could still offer discriminative validity as an individual subscale in the measure. Subsequently, an abbreviated version of the DASS-42 called DASS-21 was created, which is an adaptation of the original 42-item version and is also used to measure these three emotional states, including non-somatic symptoms. In addition to its use in the clinical setting, the DASS-21 scale has been designed to be applied to any population of interest; to date, it has been translated into more than 30 languages (J. Lee et al., 2019; Medvedev, 2023; Psychology Foundation of Australia, 2023).

The average Cronbach's alpha coefficient is 0.87, according to various sources for the Depression, anxiety and stress scale DASS-21 (Abdulaziz Alsaif, 2023; Al-Kalbani et al., 2022; Bengwasan et al., 2022; Evans et al., 2021; Formiga et al., 2021; Hakim & Aristawati, 2023; Kaji Thapa et al., 2022; Kakemam et al., 2022; Le et al., 2017; B. Lee & Kim, 2022; Makara-Studzińska et al., 2022; Montenegro Bolaños, 2017; Moya et al., 2022; Pezirkianidis et al., 2018; Ruiz et al., 2017; Simon & Bernardo, 2023; Teo et al., 2019; Thiyagarajan et al., 2022). This high alpha coefficient guarantees that the items of the DASS-21 are highly consistent with each other, making the scale a reliable instrument for measuring levels of depression, anxiety, and stress in different contexts.

DASS-21 is made up of 7 items with a Likert-type response format with 4 alternatives ranging from 0 to 3 points depending on the presence and intensity of each symptom in the last 7 days, 0=Did not apply to me at all, 1=Applied to me to some degree, or some of the time; 2=Applied to me a considerable degree or good part of time and 3=Applied to me very much, or most of the time (Psychology Foundation of Australia, 2024). Table 1 shows the items associated to each emotional state (stress, depression and anxiety) and **Appendix A** includes the content of the Scale DASS-21.

Table 1

Items associated to each emotional state for DASS-21 (Román et al., 2016)

Item number	Emotional State	Item number	Emotional State	Item number	Emotional State
3	Depression	2	Anxiety	1	Stress
5	Depression	4	Anxiety	6	Stress
10	Depression	7	Anxiety	8	Stress
13	Depression	9	Anxiety	11	Stress
16	Depression	15	Anxiety	12	Stress
17	Depression	19	Anxiety	14	Stress
21	Depression	20	Anxiety	18	Stress

Regarding the rating of the scale, it is important to consider that the sum of each subscale must be multiplied by 2 in order to identify the significance level for each emotional state, based on Table 2:

Table 2

DASS severity ratings (Lovibond & Lovibond, 1995)

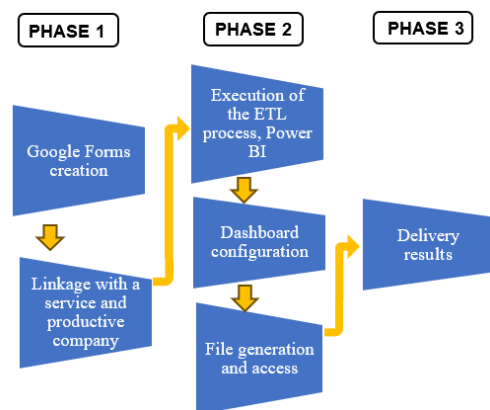
Significance level	Depression	Anxiety	Stress
Normal	0-9	0-7	0-14
Mild	10-13	8-9	15-18
Moderate	14-20	10-14	19-25
Severe	21-27	15-19	26-33
Extremely severe	28+	20+	34+

Procedure

The methodology we used for this study consisted of three phases. Figure 1 shows the methodology.

Figure 1

Methodology used for the study



Phase 1:

- **Google Forms creation:** It consisted in a Google Forms named mental health questionnaire that included a confidentiality notice, directions, sociodemographic questionnaire (gender, age, education level and working area) and DASS-21 items.
- **Linkage with a productive and service company:** During the execution of the study, we contacted service company “X” dedicated to the distribution of ice cream products and a productive company “Y” dedicated to the manufacture of boxes. **Appendix B** shows the steps we used for administering the mental health questionnaire in both organizations.

Phase 2

- **Execution of the ETL process, Power BI:** In the data extraction process, we used the Mental Health questionnaire data which was stored in a Excel Google Sheets spreadsheet, then, we obtained the link to this sheet and imported the data into Power BI; in the data

transformation process, we used Power BI query editor to clean the data by removing unwanted columns and rows, converting data types, and organizing it into tables according to the analysis requirements and in the data loading process, the transformed data was stored in the Power BI data model, enabling subsequent analysis and the creation of effective visualizations.

- **Dashboard configuration:** To configure the dashboard, we created 5 pages, each serving a specific analytical purpose: main menu; stress, depression, and anxiety severity in the organization; stress, depression, and anxiety severity by working area; consolidated severity of stress depression and anxiety and sociodemographic variables comparison.
- **File generation and access:** We created a Power BI .pbix file containing the mental health status dashboard.

Phase 3:

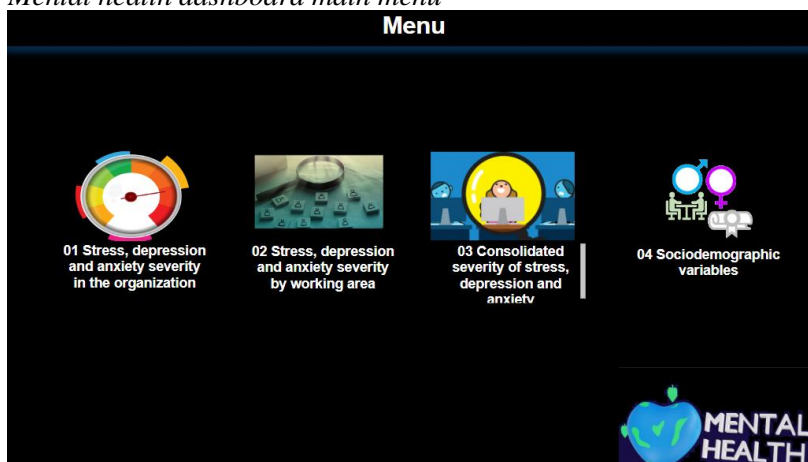
- **Delivery results:** We shared via a download link for organizational leaders to access and download the Mental Health Power BI dashboard to review the results.

RESULTS

Once we applied the mental health questionnaire in the service and productive company the results visualized for the mental health dashboard are shown in Figure 2.

Figure 2

Mental health dashboard main menu



The stress, depression, and anxiety severity of the results obtained for the service and productive companies through the dashboard are shown in Figure 3. This dashboard represents the severity levels of stress, depression and anxiety across the entire companies, as well as the employees who answered the mental health questionnaire, the progress percentage and the number of employees pending to respond. The information provided in this dashboard is organized into the following sections:

(1), (2) and (3) These sections specify the stress, depression and anxiety severity levels in the company. The results are represented by a tachometer.

(4) The section allows selecting the year and month when the mental health questionnaire was answered, enabling dynamic visualization of the severity levels of stress, depression, and anxiety within the organization. A slicer was used for this configuration.

(5), (6), and (7) These sections display the total number of employees who answered the Google Forms mental health questionnaire, the progress percentage of respondents relative to the total number of employees, and the number of employees pending to respond to the survey, respectively. The Card visual object was used for all three sections.

Figure 3

Obtained results of stress, depression, and anxiety severity in the companies. From 1 to 7 the circled numbers represent the visual sections of the dashboard (left image: service company, right image: productive company)



The severity of stress, depression, and anxiety by working area for the results obtained from service and productive companies is shown in Figure 4. This dashboard represents the number of employees by working area with their respective severity levels of stress, depression, and anxiety across the entire companies. It also includes the areas most impacted in terms of stress, depression, and anxiety levels, as well as a summary table with employees and their respective severity levels of these disorders. The information provided in this dashboard is organized into the following sections:

(1) The section allows selecting the year and month when the mental health questionnaire was answered.

(2) This section allows the identification of a specific person by their name.

(3) It allows filtering the work areas within the organization. A text filter was used for this configuration.

(4), (5), and (6) These sections allow selecting the severity level for stress, depression, and anxiety respectively.

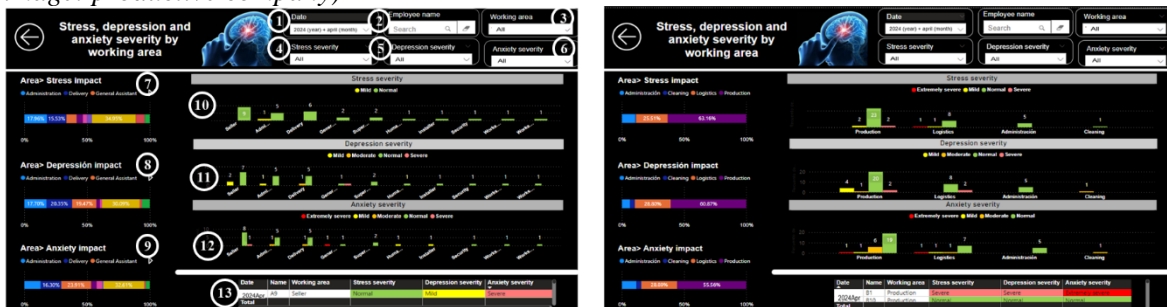
(7), (8) and (9) These sections represent the working area that has the greatest impact on the severity level of stress, depression, and anxiety, respectively. A 100% Stacked Bar Chart was used for these configurations.

(10), (11) and (12) These visualizations show the number of employees by working area and their respective severity levels for stress, depression, and anxiety disorders. A clustered column chart was used for the configuration.

(13) The table shows the names of the employees and the severity levels of stress, depression, and anxiety for each one. To ensure the confidentiality of each person, the names were coded for the service company as A1, A2, A3... An and for the productive company as B1, B2, B3... Bn.

Figure 4

Obtained results of stress, depression, and anxiety severity by working area from 1 to 13 the circled numbers represent the visual sections of the dashboard (left image: service company, right image: productive company)



The consolidated severity levels of stress, depression, and anxiety by working area are shown in Figure 5 This dashboard allows for a comparative analysis of disorder severity per employee against the overall company levels of stress, depression, and anxiety. It enables the comparison of severity levels in different working areas with those of individual employees and the entire company. Additionally, it provides a table displaying each employee's respective severity levels for the disorders, as well as identifying the working area that has the greatest impact on stress, depression, and anxiety. The information provided in this dashboard is organized into the following sections:

- (1) The section allows selecting the year and month when the mental health questionnaire was answered.
- (2) This section allows the identification of a specific person by their name.
- (3) It allows filtering the working area within the organization.
- (4) The table shows the names of the employees and the severity levels of stress, depression, and anxiety for each one.
- (5), (6), and (7) These sections include the severity levels of disorders for each employee selected with text box (2), working area selected with filter (3), and the entire organization respectively.
- (8), (9) and (10) These sections represent the working area that has the greatest impact on the severity level of stress, depression, and anxiety, respectively.

Figure 5

Consolidated severity of stress depression and anxiety by working area from 1 to 10 the circled numbers represent the visual sections of the dashboard (left image: service company, right image: productive company)



The next dashboard shown in Figure 6 includes a comprehensive breakdown of the severity levels of stress, depression, and anxiety, categorized by sociodemographic variables such as gender, education level, working area, and age. The information provided in this dashboard is organized into the following sections:

(1), (2) and (3) These sections allow selecting the severity level for stress, depression, and anxiety respectively.

(4) This entire section includes the comparison of stress against gender, education level, working area, and age, showing the number of people with the severity conditions filtered through (1).

(5) This entire section includes the comparison of depression against gender, education level, working area, and age, showing the number of people with the severity conditions filtered through (2).

(6) This entire section includes the comparison of anxiety against gender, education level, working area, and age, showing the number of people with the severity conditions filtered through (3).

Figure 6

Sociodemographic variables comparison, from 1 to 6 the circled numbers represent the visual sections of the dashboard (left image: service company, right image: productive company)



DISCUSSION

The implementation of a mental health dashboard using Power BI in the two analyzed companies allowed for dynamic and real time monitoring of stress, anxiety, and depression severity levels among employees. This approach facilitated detailed comparisons by

sociodemographic variables and specific working areas, providing managers with a broader perspective to ensure relevant and effective intervention strategies for employees.

Regarding the service company, the following was identified: the severity levels for stress, depression, and anxiety across the entire company remain within normal ranges, reflecting a favorable environment within the organization. For the General Assistant working area, there is a mild condition in depression and a moderate condition in anxiety; for the packer, a mild condition in anxiety; and for human resources, a mild condition in anxiety. Appropriate support measures should be taken for employee A18 due to the extremely severe condition in anxiety and severe condition in depression, considering that NOM-035-STPS-2018 commands mandatory intervention for disorders with extremely severe levels. Preventive measures should be taken for employees A6, who has a moderate condition in depression and anxiety; A9, who has a severe condition in anxiety; and A26, who has a moderate condition in anxiety.

Regarding the productive company, the following findings were identified: the severity levels for stress, depression, and anxiety across the entire company remain within normal ranges. In the cleaning working area, there are moderate levels of depression and anxiety. Employee B1 requires adequate support due to the extremely severe anxiety, along with severe stress and depression. Similarly, employee B43 needs support for the extremely severe stress and anxiety, coupled with severe depression. Preventive measures should be considered for individuals presenting severe conditions: B7, who exhibits severe depression, moderate anxiety, and mild stress; B17, who shows severe stress; and B23, who has mild stress, severe depression, and moderate anxiety.

CONCLUSIONS

The results obtained through the Power BI dashboard provided a comprehensive view of stress, anxiety, and depression levels in both the productive and service organizations, as well as in specific working areas and at the individual level. Analyzing the data by working area revealed significant differences in stress and anxiety levels between departments and among employees, highlighting the importance of adapting wellness strategies to the specific needs of each section, based on each company's organizational intervention programs. The individual analysis identified employees with extremely severe levels of stress, anxiety, and depression, facilitating the implementation of personalized and timely interventions. These results underscore the utility of the Power BI dashboard not only for general monitoring but also for the precise identification of risk areas and the application of preventive and corrective measures at different levels within the organization. The integration of this type of tool ensures compliance with the regulatory framework, such as NOM-035-STPS-2018, which requires the identification and prevention of psychosocial risk factors at work. By providing a detailed and continuous assessment of employees mental wellbeing, companies can not only improve the health and productivity of their

workforce but also ensure adherence to current legal regulations, avoiding sanctions and promoting a safer and healthier work environment.

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