



IRSC 2022

INTERNATIONAL RAILWAY
SAFETY COUNCIL

SEVILLA, OCTOBER 16-21,
2022



The logo for Ineco, featuring a stylized blue and red vertical bar followed by the word "ineco" in a bold, blue, sans-serif font. The logo is enclosed within a thin orange circular border.





TATIANA RUEDA MARTÍNEZ

Technical Manager. INECO



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HUMAN FIRST

When Human Factors and Safety Walk Together



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CHAPTER 1

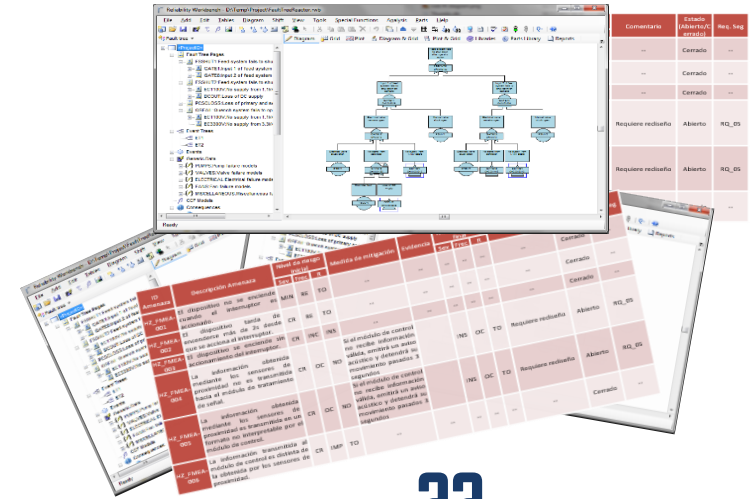
Introduction



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INTRODUCTION



INTRODUCTION

EUROPEAN STANDARD

EN 50126-1

NORME EUROPÉENNE

EUROPÄISCHE NORM

October 2017

ICS 29.280; 45.020

Supersedes EN 50126-1:1999

English Version

Railway Applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) - Part 1: Generic RAMS Process

Applications ferroviaires - Spécification et démonstration de la fiabilité, de la disponibilité, de la maintenabilité et de la sécurité (FDMS) - Partie 1: Processus FDMS générique

Bahnwendungen - Spezifikation und Nachweis von Zuverlässigkeit, Verfügbarkeit, Instandhaltbarkeit und Sicherheit (RAMS) - Teil 1: Generischer RAMS Prozess

This European Standard was approved by CENELEC on 2017-07-03. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

5.6.4 Human factors

Human factors are a core aspect within an integrated RAMS management process. An analysis of human factors, with respect to their effect on system RAMS, is inherent within the "systems approach" applied by this standard.

NOTE Guidance given by standards is rare but can be found in further European Standards, such as guidance on ergonomic design in EN 814.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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INTRODUCTION



INTRODUCTION

HUMAN First



INTRODUCTION

Railway Safety Area



Innovation Area



Aeronautical Safety Area



First benefits, before even starting!

- ✓ Finding a lot in common, knowledge and experience to share
- ✓ Transversal orientation of the project
- ✓ method valid for Railways and Aircraft operation, would be suitable for any other sector

INTRODUCTION

2016-2017

- ✓ Benchmarking of the Human Factors techniques
- ✓ Integration into risk analysis processes : practical and transversal
- ✓ First version of the Integration of the Human Factor into the Risk Assessments methodology



2018

- ✓ Improving methodology, changing the process, adapting and improving evaluation techniques
- ✓ University cooperation in the project



2019-2020

- ✓ Award for the best Ineco innovation project.
- ✓ CANSO Award
- ✓ Firts international Ineco's webinar



2021-2022

- ✓ Development of a tool for the application of the methodology.
- ✓ Human Performance Analysis using Data Science.
- ✓ Development of new products within the product line "Human First": InFact, BioMaF and GFA tool.



NEXT

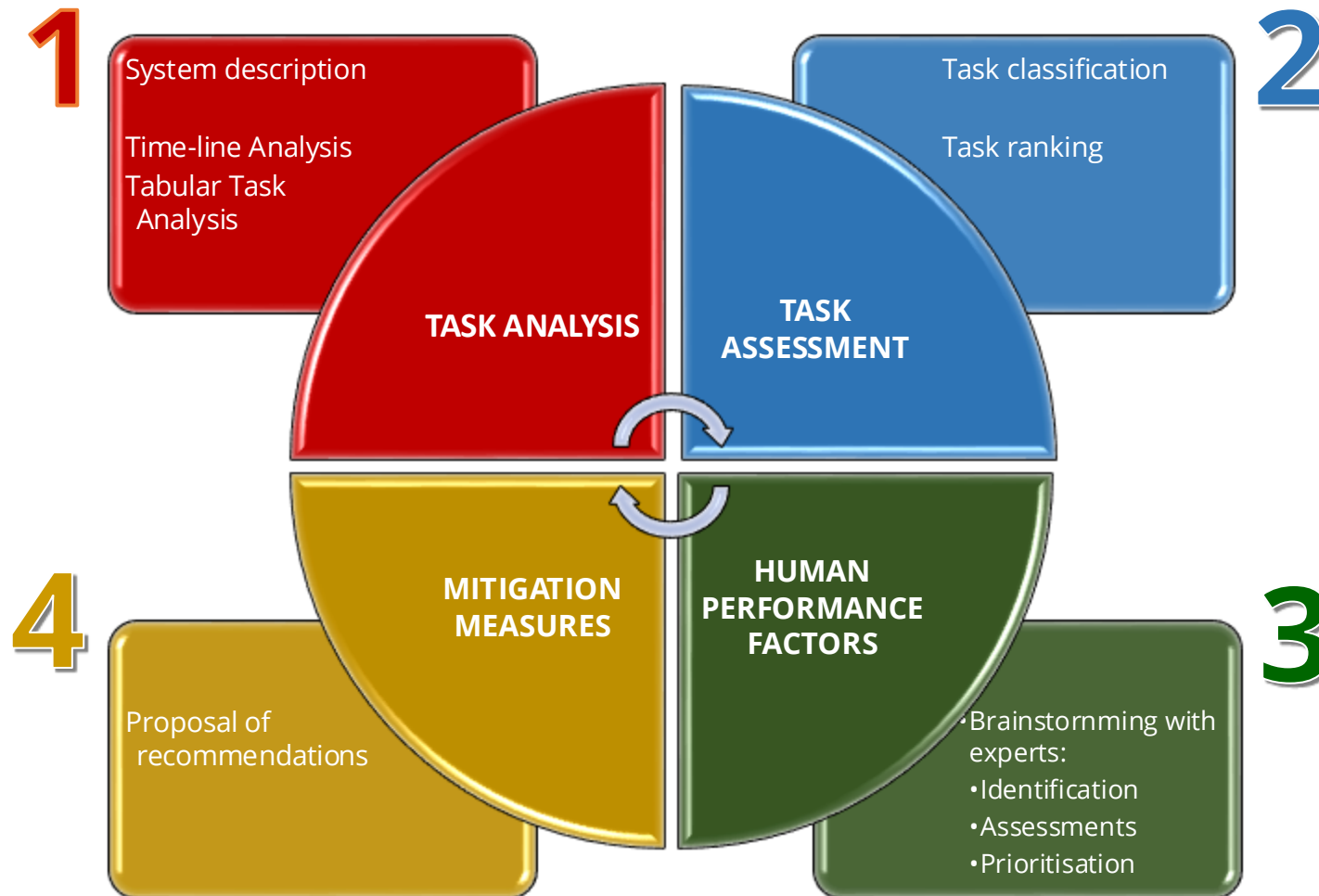
- ✓ Consolidation of the Human First line product.
- ✓ Research on new trends (resilience engineering, Safety II).



CHAPTER 2

Integrating Human Factors in Risk Analysis

INTEGRATING HUMAN FACTORS IN RISK ANALYSIS



INTEGRATING HUMAN FACTORS IN RISK ANALYSIS

System Description

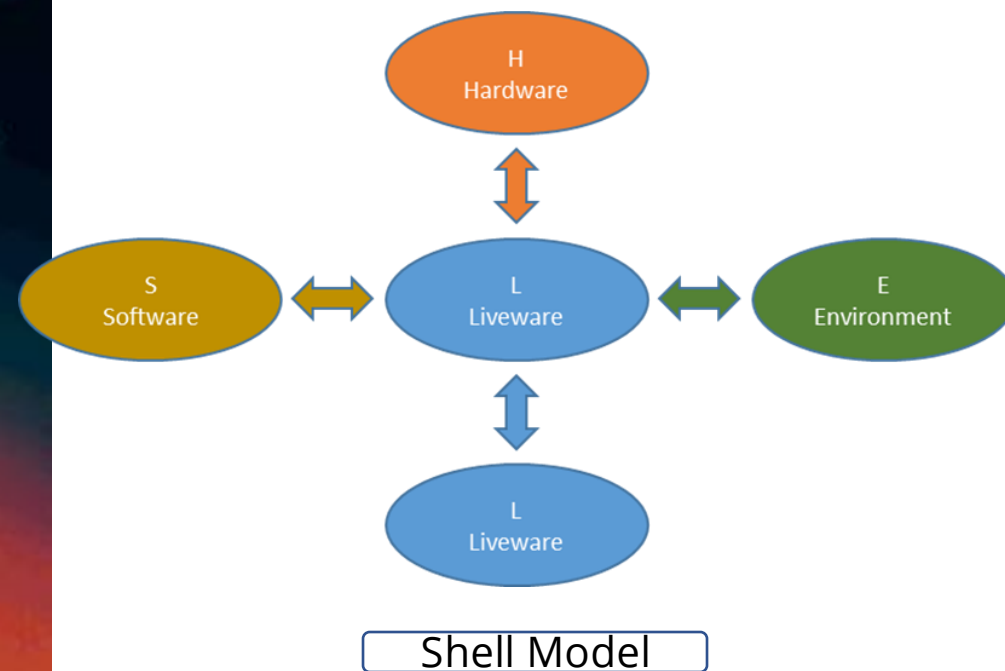
1



INTEGRATING HUMAN FACTORS IN RISK ANALYSIS

1

System Description



INTEGRATING HUMAN FACTORS IN RISK ANALYSIS

2

Task Assessment



INTEGRATING HUMAN FACTORS IN RISK ANALYSIS

3

Human Performance Factors



INTEGRATING HUMAN FACTORS IN RISK ANALYSIS

4

Mitigation Measures

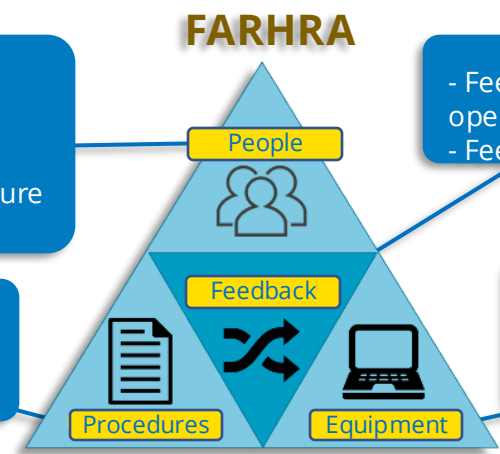


- People:**
- Competencies
 - Psychophysical condition
 - Organizational culture
 - Human team

- Procedures:**
- Procedures
 - Standards

- Feedback:**
- Feedback during operation
 - Feedback after operation

- Equipment:**
- Software
 - Hardware
 - Ergonomics



Feasible Action Rules for Human Reliability Assessment

INTEGRATING HUMAN FACTORS IN RISK ANALYSIS



Systematic and practical methodology

Work as done VS work as imagine

Comprehensive and transversal

Specific recommendations for the improvement of human performance

CANSO Award Winning Methodology

Ineco wins CANSO Global Safety Achievement Award 2019

<https://www.atc-network.com/atc-news/canso-and-ineco/ineco-wins-canso-global-safety-achievement-award-2019>

CHAPTER 3

Next steps: Process automation and the use of the data science

NEXT STEPS: PROCESS AUTOMATION AND THE USE OF THE DATA SCIENCE



Our iHISA tool...

Metodología para la integración del Factor Humano en los Análisis de Riesgos ineco

Objetivo: La metodología desarrollada por Ineco busca solventar la necesidad de incluir el factor humano en los análisis de riesgos convencionales con el objetivo final de contribuir mejorando la seguridad a través de la implantación y seguimiento de medidas de mitigación.

La información facilitada no se empleará para fines distintos de la mejora de la seguridad. La investigación del suceso analizado seguirá los principios de cultura justa, teniendo como objetivo la prevención de futuros incidentes y no la atribución de culpas o responsabilidades. La recopilación de datos para cada caso estudiado será anónima y desidentificada.

EXISTING SAFETY ASSESSMENT PROCESS HUMAN PERFORMANCE ASSESSMENT TO INTEGRATE

SYSTEM DESCRIPTION	TASK ANALYSIS	Hoja Actores, Roles, Tareas
HAZARDS IDENTIFICATION	HF ISSUES IDENTIFICATION	Hoja K2D_HPI_VCT_Ranking
HAZARDS RISK ASSESSMENT	TASK/ PERFORMANCE ASSESSMENT	Hoja K2D_HPI_VCT_Ranking
HZ CAUSES / EFFECTS ANALYSIS	H.F. AFFECTION (PSFs ID)	Hoja PSFs
RISK MITIGATION MEASURES → SRs	H.C. REDUCTION MEASURES → H.C.SRs	Hoja
SRs IMPLEMENTATION/FOLLOW-UP	H.C. SRs IMPLEMENTATION/FOLLOW-UP	Hoja

Instrumentos y modelos utilizados

FIRST HUMAN FIRST

RESULTADOS

Archivos de file
 * EQ2
 * L178
 * F17
 Total general:

Descripción tareas

- Concesión de la vía
- Dar la orden de marcha
- Estacionar el tren
- Peticion de via
- Si detecta itinerario in...

Suma de tareas

Distribución del riesgo entre las 5 tareas más críticas

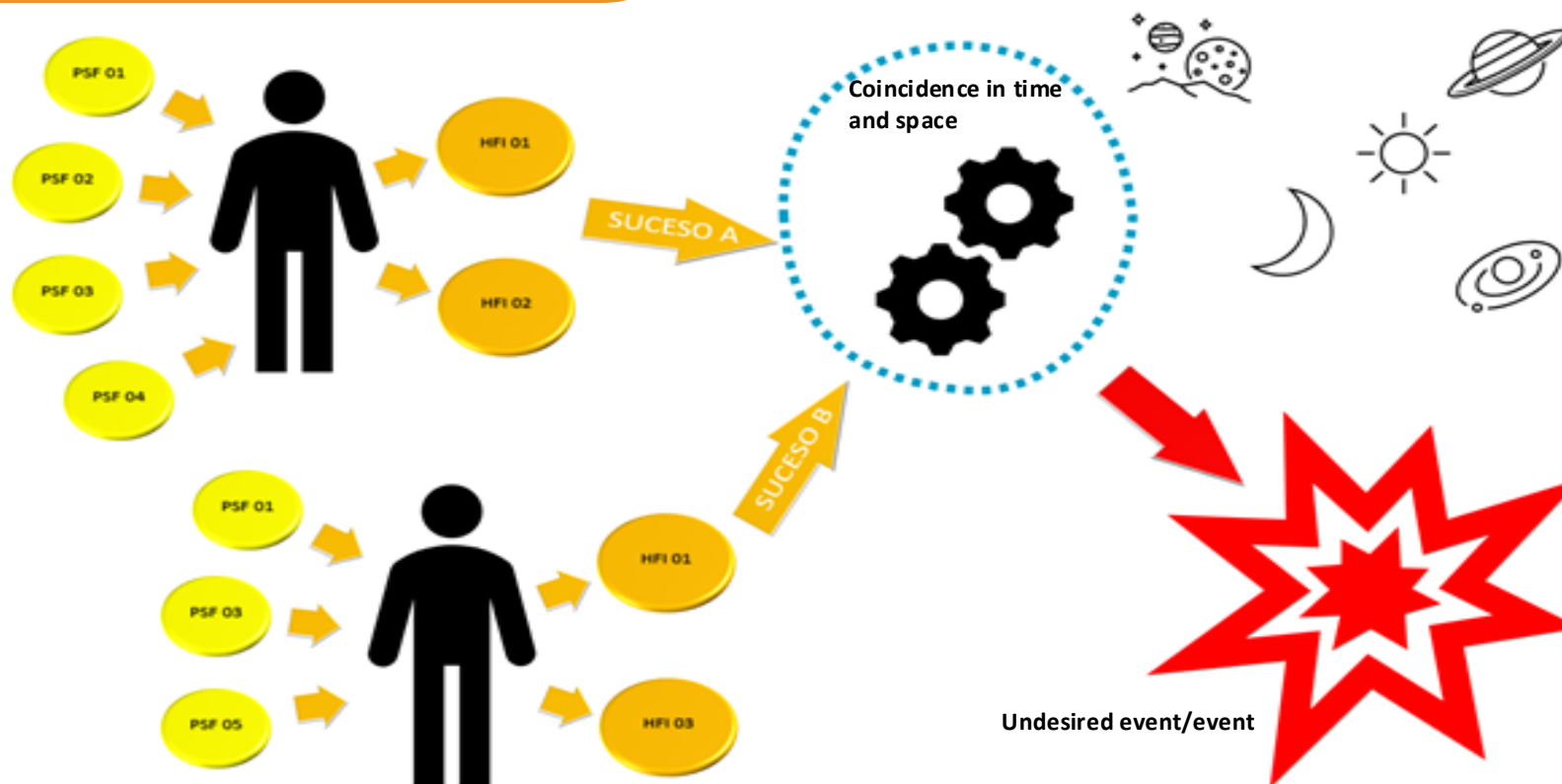
43%	15%	10%	15%	17%
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Nivel de riesgo SRs medidas de mitigación: **45**

Nivel de riesgo CDm medidas de mitigación: **25**

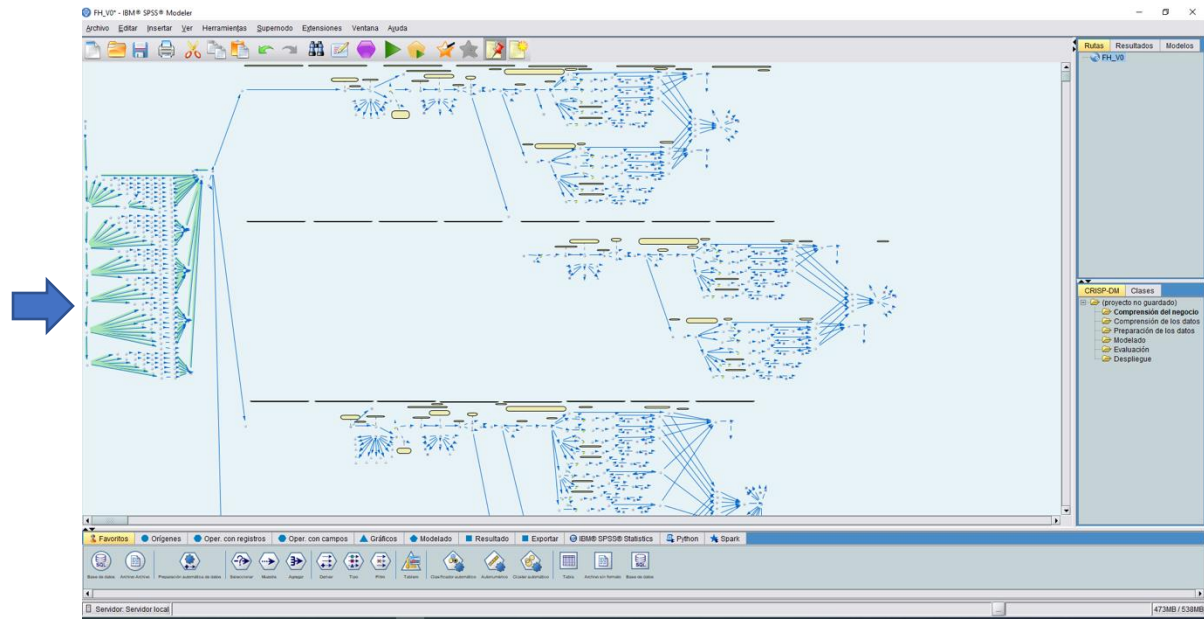
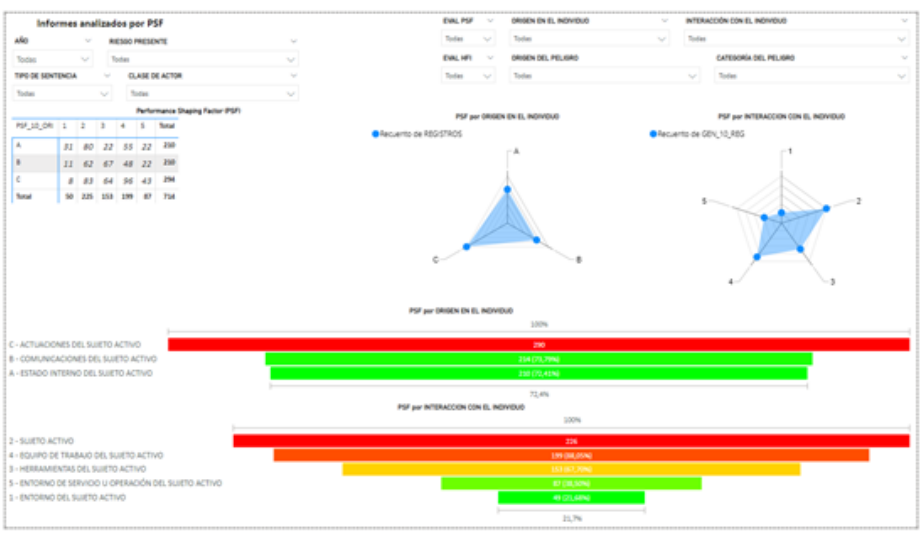
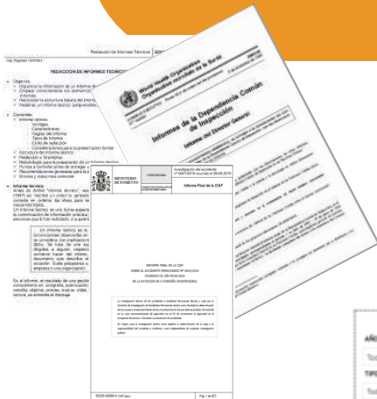
NEXT STEPS: PROCESS AUTOMATION AND THE USE OF THE DATA SCIENCE

The InFact tool and data base



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The InFact tool and data base



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NEXT STEPS: PROCESS AUTOMATION AND THE USE OF THE DATA SCIENCE

The BioMaF model

Objective

FATIGUE

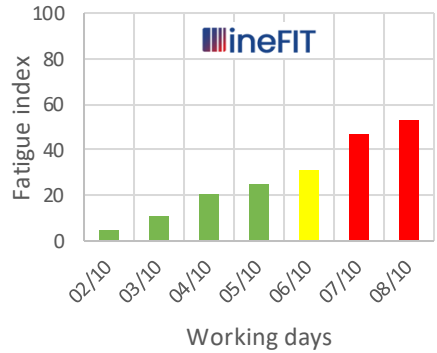
Subjective

The screenshot shows the 'saerco' Performance monitoring interface. On the left, there is a table with columns for 'Members of specialties', 'Name', 'DOB', 'Performance', 'Circadian', 'Restlessness', and 'Fatigue'. The table lists several employees like 'Manuel Angel', 'Jose Miguel', 'Dierald', 'Angel', 'Rocio', 'Sandra', and 'Cristina Angel'. On the right, there are actigraphy graphs showing activity levels over time for different employees, with a legend for 'Sleep' and 'Awake' states.

The 'ActiGraph Sleep Log' form includes fields for 'Name', 'DOB', and 'Comments'. It features a grid for recording sleep patterns over a 24-hour period, with columns for 'Pre-midnight', 'Midnight', and 'Post-midnight'. A legend at the bottom indicates 'Leave bed' and 'Enter Out of Bed'.

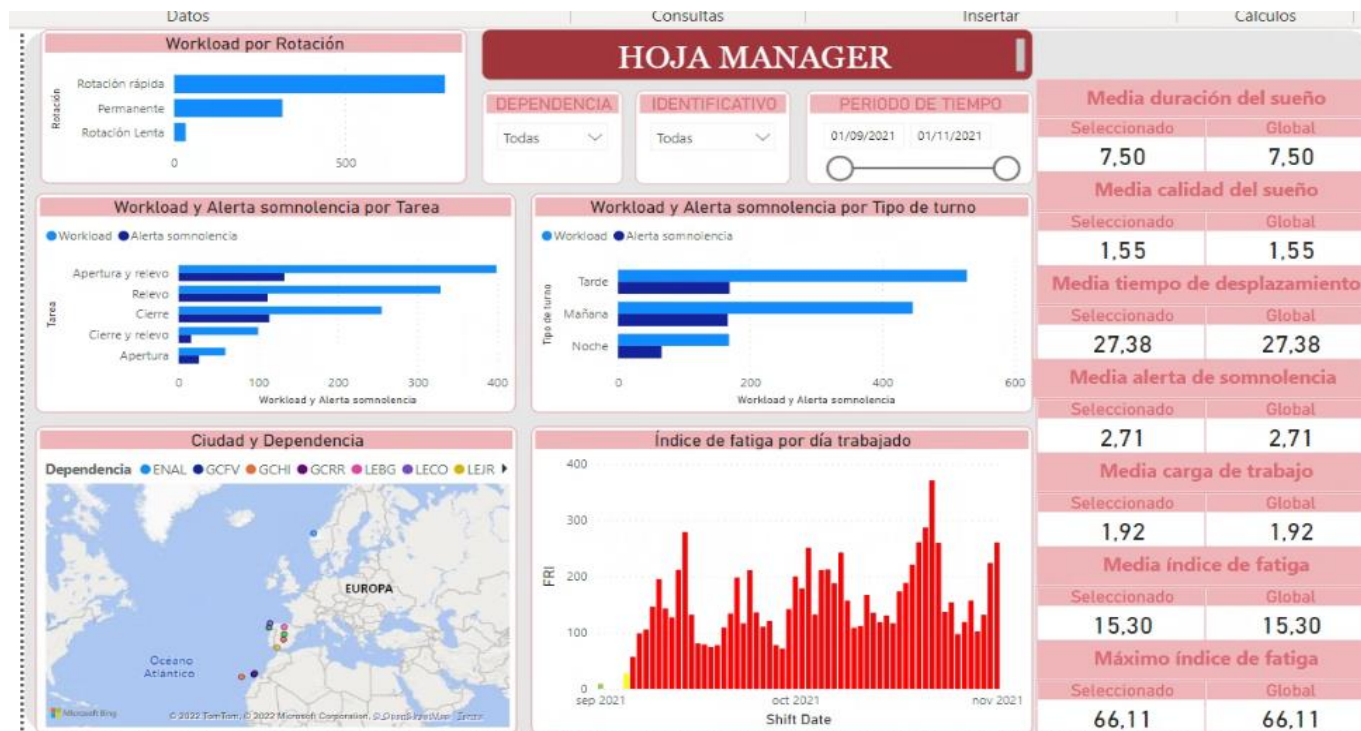
The 'WAQ CREW Quest. SannPerelli' questionnaire asks about work-related fatigue. It includes sections for 'Workload at the end of the shift' (with sub-sections for 'Ask help during the shift' and 'Hours of experience as a controller'), 'Gender', 'Age', and 'How you feel...'. It also includes a 'Thank you very much for your cooperation.' message.

(Samm & Perelli, 1982; Samel et al, 1997)



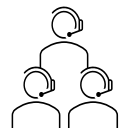
NEXT STEPS: PROCESS AUTOMATION AND THE USE OF THE DATA SCIENCE

The BioMaF model



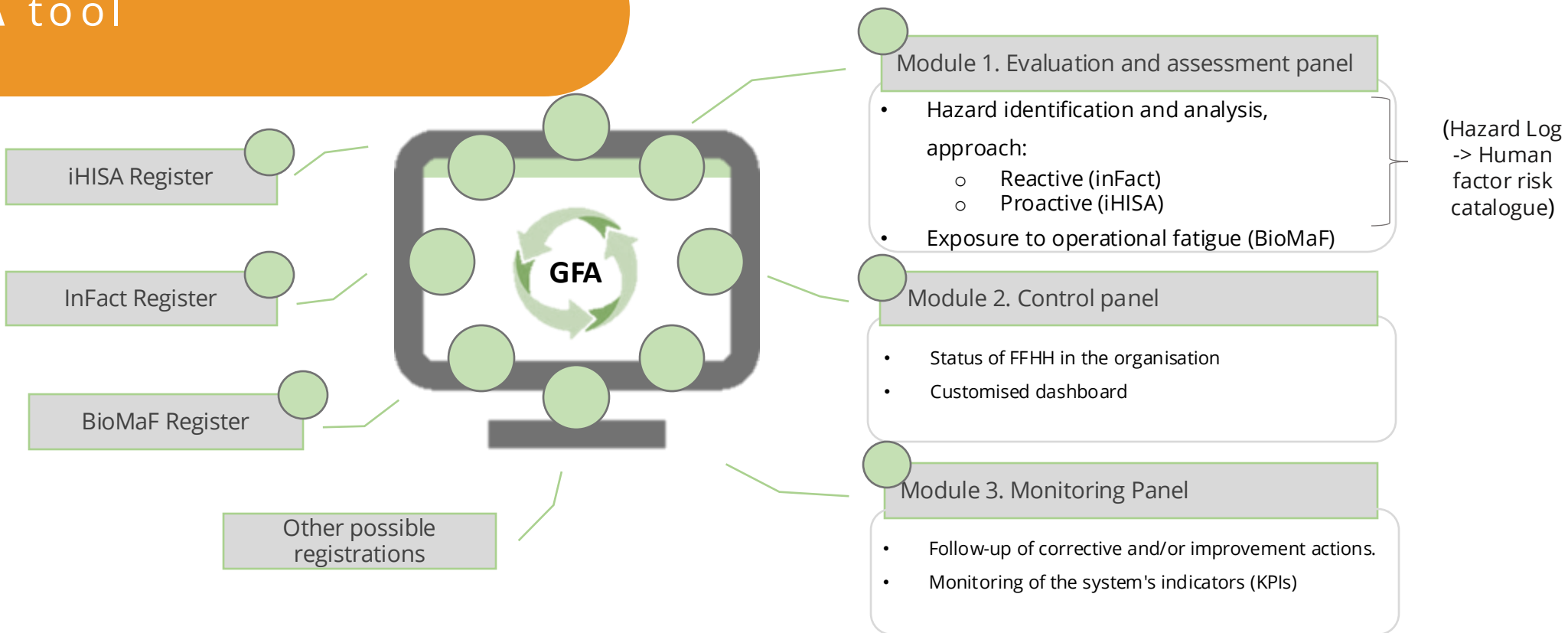
Seleccione un identificador			Número de dependencias: 26	
Horas trabajadas	Horas trabajadas	Horas trabajadas	Total horas trabajadas	
182	10,20	27,20	228,70	
79,76	4,46	11,89	100	

Seleccione un identificador			Número de dependencias: 26	
Horas trabajadas	Horas trabajadas	Horas trabajadas	Total horas trabajadas	
3110	301,10	156,70	3,62 mil	
85,91	8,32	4,33	100	



NEXT STEPS: PROCESS AUTOMATION AND THE USE OF THE DATA SCIENCE

The GFA tool





COMPANY
LOGO

www.irsc2022.com

