

**MINISTRY OF EDUCATION AND RESEARCH  
IOSUD UNIVERSITY OF PETROȘANI  
DOCTORAL SCHOOL  
DOCTORAL FIELD: INDUSTRIAL ENGINEERING**



**Eng. Adrian TOMA**

# **DOCTORAL THESIS**

**-SUMMARY -**

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**DOCTORAL THESIS**

**-SUMMARY -**

***BEHAVIOR-BASED SAFETY PROCESS  
APPLIED IN MULTICULTURAL INDUSTRIAL  
WORK ENVIRONMENTS***

**Conducător de doctorat:**

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# CONTENTS

**INTRODUCTION..... 5**

- I. The importance, relevance and purpose of doctoral research..... Error! Bookmark not defined.**
- II. Structure and brief description of the thesis content ..... Error! Bookmark not defined.**

**CHAPTER 1. OBJECTIVES AND CONCEPTUAL-METHODOLOGICAL FRAMEWORK OF THE RESEARCH..... Error! Bookmark not defined.**

- 1.1 Conceptual and methodological highlights of the Behavior-Based Security concept Error! Bookmark not defined.**
- 1.2 Justification of the need for research..... Error! Bookmark not defined.**
- 1.3 Objectives of the doctoral thesis ..... Error! Bookmark not defined.**
- 1.4 The logic and development of the research ..... Error! Bookmark not defined.**
- 1.5 Flowchart of the stages followed in the development of doctoral research ..... 7**

**CHAPTER 2 COMPARATIVE CRITICAL ANALYSIS OF SCIENTIFIC CONTRIBUTIONS IN THE FIELD OF BEHAVIOR-BASED SAFETY ..... Error! Bookmark not defined.**

- 2.1 Fundamental contributions to the development of SBC theory ..... Error! Bookmark not defined.**
- 2.2 Causation models of work accidents..... Error! Bookmark not defined.**
- 2.3 The eras of OSH management ..... Error! Bookmark not defined.**
- 2.4 Traditional paradigms vs. behavioral paradigms..... Error! Bookmark not defined.**
- 2.5 Fundamental models of behavior-based safety (SBC) ..... Error! Bookmark not defined.**
- 2.6 Statistics on major accidents in the Kuwaiti oil industry ..... Error! Bookmark not defined.**

**CHAPTER 3. THE FUNDAMENTALS OF THE BEHAVIOR-BASED SAFETY CONCEPT Error! Bookmark not defined.**

- 3.1 Theoretical and empirical foundations of applied behavior analysis ..... Error! Bookmark not defined.**
- 3.2 Types of human error and risk taking..... Error! Bookmark not defined.**
- 3.3 Individual risk assessment and risk compensation ..... Error! Bookmark not defined.**
- 3.4 Current issues in OSH improvement efforts..... Error! Bookmark not defined.**
- 3.5 Final findings of the chapter ..... Error! Bookmark not defined.**

**CHAPTER 4. TECHNICAL DESCRIPTION OF THE INDUSTRIAL TECHNOLOGICAL PROCESS AND OPERATIONAL CONTEXT ..... Error! Bookmark not defined.**

- 4.1 Technical description of drilling rigs ..... Error! Bookmark not defined.**
- 4.2 Overview of specific operational steps..... Error! Bookmark not defined.**
- 4.3 Identification and analysis of risks specific to drilling operations ..... Error! Bookmark not defined.**
- 4.4 Human risks in critical operations ..... Error! Bookmark not defined.**
- 4.5 Technical-operational organization chart ..... Error! Bookmark not defined.**

4.6 Demographic and multicultural distribution of the workforce..... Error! Bookmark not defined.

**CHAPTER 5: APPLIED BEHAVIORAL ANALYSIS AND SAFETY CULTURE ASSESSMENT THROUGH OBSERVATIONAL AND PSYCHOMETRIC SURVEY ..... Error! Bookmark not defined.**

5.1 Theoretical foundations of tracking observable behavior in OSH..... Error! Bookmark not defined.

5.2 Applied research methodology ..... Error! Bookmark not defined.

5.3 Results of the first survey on occupational safety culture..... Error! Bookmark not defined.

5.4 Second survey on occupational safety culture ..... Error! Bookmark not defined.

5.5 Final findings of the chapter ..... Error! Bookmark not defined.

**CHAPTER 6. APPLICATION PHASE OF THE DO IT PROCESS: DESIGN, IMPLEMENTATION AND EVALUATION OF BEHAVIORAL OBSERVATIONS IN OCCUPATIONAL SAFETY..... Error! Bookmark not defined.**

6.1 Preamble: behavioral foundations of intervention..... Error! Bookmark not defined.

6.2 Behavioral intervention design ..... Error! Bookmark not defined.

6.3 Intervention preparation stage and assessment of reference behaviors ..... Error! Bookmark not defined.

6.4 Behavioral observations phase ..... Error! Bookmark not defined.

6.5 Behavioral intervention design ..... Error! Bookmark not defined.

6.6 The interaction between learning types: an integrative perspective on behavioral security training..... Error! Bookmark not defined.

**CHAPTER 7. INTEGRATED ANALYSIS OF THE EFFICIENCY OF BEHAVIORAL INTERVENTION IN THE FIELD OF OCCUPATIONAL SAFETY ..... Error! Bookmark not defined.**

7.1 Behavioral intervention support and feedback in Locations A and F ..... Error! Bookmark not defined.

7.2 Combined intervention strategy for sites B and D: reconfiguring the work environment and strengthening leadership to develop a sustainable safety culture ..... Error! Bookmark not defined.

7.3 Motivational intervention and reward systems: location C..... Error! Bookmark not defined.

7.4 The role of the control group in evaluating the effectiveness of interventions: study at site E..... Error! Bookmark not defined.

**CHAPTER 8. FINAL CONCLUSIONS AND PERSONAL CONTRIBUTIONS. LIMITATIONS OF THE STUDY AND DIRECTIONS FOR FURTHER RESEARCH DEVELOPMENT ..... 9**

8.1 Final conclusions on the research conducted ..... Error! Bookmark not defined.

8.2 Personal contributions ..... Error! Bookmark not defined.

8.3 Limitations of the study ..... Error! Bookmark not defined.

8.4 Directions for further research development ..... Error! Bookmark not defined.

**References ..... 15**

**ANNEXES ..... Error! Bookmark not defined.**

## 1. KEYWORDS

For a better understanding of the following exposition, it is necessary to list a few notions specific to the field addressed: behavior-based security; *OH&S management; IT DO process; tracking observable behavior in OH&S; behavioral intervention strategies; observational and psychometric survey; values, intentions and behaviors of active concern; demographic and multicultural distribution of the workforce; multicultural industrial environment; security performance* .

## 2. IMPORTANCE, CURRENTNESS AND PURPOSE OF DOCTORAL RESEARCH

Occupational safety has become, in recent decades, a key topic in interdisciplinary research applied to the industrial field, especially in high-risk sectors such as the oil and drilling industries. In this context, traditional approaches focused strictly on legal compliance, formal audits and general training have proven, in many cases, insufficient. Therefore, a paradigm shift is required – a shift in focus from what is done to how it is done, through direct observation, assessment of attitudes and correction of risky behaviors in real time. Thus, the concept of *Behavior Based Safety (BBS)* appears as a scientific and practical solution for reducing risks by modifying unsafe behaviors before they lead to accidents..

This doctoral research is built on the belief that *Occupational Safety* is not just a managerial responsibility, but a result of collective involvement, distributed attention, and the formation of safe reflexes at every operational level.

*The relevance of the topic* is supported by global data. According to ILO estimates, over 340 million work-related accidents and over 160 million cases of occupational diseases are recorded annually. Underreporting remains a major problem, and in regions with intensive work regimes, the real data can far exceed official reporting. The social and economic costs are huge – in the USA, for example, the National Council for Occupational Safety and Health estimates losses of over \$160 billion annually, and in the European Union, work-related accidents generate losses of 3.3% of GDP. In an industry where each incident can have catastrophic consequences, the effectiveness of prevention systems increasingly depends on the organization's ability to transform work safety into a personal value, not just an external obligation. Behavior-Based Safety is emerging, in this sense, as an essential tool in forming safe reflexes, in cultivating a proactive attitude towards risk and in reducing dangerous behavioral deviations.

*The purpose of this research* is threefold:

1. *Scientific* – by validating an applied behavioral model, based on systematic observations, behavioral measurement tools and empirically validated interventions, this work makes an original contribution to the specialized literature in the field of occupational safety, organizational psychology and risk management. The study is part of a line of research that aims to understand the mechanisms by which individual and collective behaviors influence performance regarding Occupational Safety.

2. *Applied* – by directly implementing Behavior-Based Safety programs on real sites, in concrete working conditions, within multicultural teams. The research offers applicable solutions to industrial companies that want to improve safety culture and reduce the accident rate without major investments in infrastructure or technology, but through human resource management and observable behavior.

3. **Strategic** – because the results can be extended to the organizational level and can substantiate internal prevention policies, continuous training, human risk assessment and behavioral audit. At the same time, the study offers recommendations that can be adapted to other high-hazard industries (chemical, construction, energy), contributing to the development of a sustainable safety culture, based on personal responsibility, visible leadership and collective commitment.

This research does not only propose a specific solution, but supports the idea that safety is an educational and relational process, which is built through trust, repetition, involvement and continuous support. In this way, the thesis makes a valuable contribution to the reconfiguration of the way in which industrial companies define and experience occupational safety – not as a set of rules, but as a living system, anchored in the behavioral culture of the people who give them life every day.

### 3. OBJECTIVES OF THE DOCTORAL THESIS

#### i. General objectives

The general objectives of the doctoral research program aimed at:

- ✚ **General Objective 1:** Theoretical and methodological substantiation of the Behavior Based Security (BBS) model;
- ✚ **General Objective 2:** Building and testing a set of tools for observing and modifying risky behaviors;
- ✚ **General Objective 3:** Applying and validating a BBS program in an operational context, with comparative analysis between sites;
- ✚ **General Objective 4:** Formulating recommendations for the extension and adaptation of the model in other industrial contexts, including in Romania.

These set objectives are to be achieved through empirical case studies conducted, each of which addresses one or more of the objectives established and mentioned above..

#### ii. Objective specific

Specific objectives of the research program are:

**Specific research objective 1:** Analysis of the specialized literature on behavioral models applied in the field of occupational safety

**Specific research objective 2:** Investigation of the cultural, organizational and operational characteristics of multicultural teams in the oil industry

**Specific research objective 3:** Identification of critical behaviors and development of behavioral observation lists

**Specific research objective 4:** Design and testing of feedback sheets and behavioral perception questionnaires

**Specific research objective 5:** Training observers and instructing them in the application of the DO IT methodology

**Specific research objective 6:** Implementation of the intervention and evaluation of the results through quantitative and qualitative methods

**Specific research objective 7:** Evaluation of the impact of the intervention and comparison of performances between sites with and without intervention

**Specific research objective 8:** Formulation of a replicable and adaptable application model for other industries, including in the Romanian context

The table below summarizes the correlation of the general objectives with those specific:

General objective	Content / Main purpose	Related specific objectives							
		OS1	OS2	OS3	OS4	OS5	OS6	OS7	OS8
OG1	Theoretical and contextual foundation of the research	X	X						
OG2	Tool construction and implementation preparation			X	X	X			
OG3	Practical application, impact assessment and intervention validation						X	X	X
OG4	Extension and transferability of the model to other industrial contexts								X

Table 1.1. General objectives and how they correlate with specific research objectives

### b. Flowchart of the stages followed in the development of the doctoral research

The stages of the doctoral research were structured in a logical, sequential manner, reflecting the transition from theoretical construction to practical validation, with an emphasis on adaptability, applicability and methodological coherence. Each stage was designed to contribute to the consolidation of the formulated objectives and the scientific substantiation of the proposed model.

## 3. STRUCTURE AND BRIEF DESCRIPTION OF THE THESIS CONTENT

The structure of the doctoral thesis was designed to logically and progressively reflect the development of the proposed theme, from the conceptual foundations and theoretical justification of behavior-based security (BBS) to the analysis of the real impact of behavioral interventions in the operational environment specific to the oil industry. Each chapter has a distinct role and contributes to the articulation of an applied research, scientifically supported and anchored in the realities of organizational risks. Thus:

### *Chapter 1: Objectives and conceptual-methodological framework of the research*

The chapter includes a rigorous description of the methodology used, both qualitatively and quantitatively, as well as the logic of the phasing of the scientific approach. Through the presented logical scheme, a clear vision is offered on the correlation between objectives, methods and results, thus providing the reader with an overview of the structure and coherence of the work.

### *Chapter 2: Evolution of Occupational Safety and Health Approaches*

Chapter 2 provides a historical and critical analysis of the main occupational safety paradigms – from reactive and punitive models to proactive and behavior-focused approaches. A key contribution of this chapter is the inclusion of a section dedicated to major accidents in the Kuwaiti oil industry, analyzed as case studies to understand systemic deficiencies. Historical statistics of incidents and non-conformities in the analyzed companies are also presented, providing a realistic and substantiated picture of why a behavior-based intervention is necessary.

### *Chapter 3: Foundations of the Behavior-Based Safety Concept*

The role of feedback, motivation, and organizational learning in building sustainable safe behaviors is discussed. The concepts of “deviation normalization” and “risk

compensation” are introduced, useful in understanding behavioral resistance to change. The chapter functions as a theoretical bridge between psychological concepts and their practical applicability in drilling operations..

***Chapter 4: Technical description of the industrial technological process and the operational context***

A central chapter for understanding the framework in which the research was conducted, this section details the technological processes involved in drilling activities – from the equipment used to the daily operational flows. Descriptions of the installations, sketches, photographs and explanations of the risks associated with each stage are included. A distinctive element of this chapter is the inclusion of an organizational chart of the operational structure, detailing the levels of competence, experience, training and responsibility of the personnel involved. An analysis of the demographic and multicultural distribution of the teams – with reference to age, nationality, experience, education – is also carried out, highlighting the impact of these factors on the perception of risk and the adoption of safe behaviors. This section provides the necessary framework for understanding the complexity of the interventions implemented subsequently.

***Chapter 5: Identification of critical behaviors and development of observation tools***

The chapter describes the methodology used to identify critical behaviors that directly influence occupational safety. The application of the DO IT process (Define, Observe, Intervene, Test) is presented, adapted to the specifics of oil sites. Behavioral checklists are developed and the process of training observers, methods of recording behaviors and analyzing their frequency are detailed. The chapter highlights how behavioral data can be systematically collected and used as a starting point for relevant and sustained interventions over time. The importance of the transition from unconsciousness to behavioral awareness through continuous training and coaching is also emphasized.

***Chapter 6 – Intervention Strategies and Their Application on Sites***

The implementation stages are described in detail: announcing the program, forming observer teams, conducting observation campaigns, processing feedback, adjusting messages, and involving formal and informal leaders. The chapter also includes detailed statistics on incidents and non-conformities observed during implementation, compared to previous periods, providing a clear picture of behavioral progress.

***Chapter 7 – Impact of Interventions and Analysis of Safety Evolution in the Field***

Provides a comprehensive analysis of the impact of behavioral interventions on safety culture and work performance. Quantitative and qualitative indicators are used to highlight the transformations generated by the implementation of Behavior-Based Safety programs: reducing unsafe behaviors, increasing proactive behaviors, improving risk communication, and developing direct staff involvement in promoting safety. A comparison is made between intervention sites and control groups to isolate the direct effect of the applied strategies.

***Chapter 8 – Final conclusions and personal contributions. Limitations of the study and directions for further research development***

The final chapter synthesizes the entire research and provides an overview of the efficiency, applicability and relevance of the behavior-based approach. The objectives of the paper are reaffirmed and their achievement is demonstrated, through concrete evidence. The added value that BBS interventions bring to the oil sector, in a sustainable and reproducible way, with direct results on work safety, operational efficiency and team cohesion is highlighted..

## **5. PERSONAL CONTRIBUTIONS. LIMITATIONS OF THE STUDY AND DIRECTIONS FOR FURTHER RESEARCH DEVELOPMENT**

The doctoral research confirmed that Behavior Based Security (BBS) is a viable and sustainable approach in the oil industry, capable of generating comparable or even superior results to technical investments.

### **b. Personal contributions**

#### **i. Theoretical contributions.**

A.1. First, we have deepened and reinterpreted the classical causality models – Heinrich, Bird, Reason and Hollnagel – demonstrating that their explanatory value remains important, but limited if applied in isolation. We have shown that these models provide a useful framework for understanding the causal chain of accidents, but that, in the current conditions of the oil industry, they need to be complemented by modern concepts such as deviation normalization and risk compensation.

A.2. Second, we have integrated the theoretical contributions of established authors such as Dan Petersen [170], Scott Geller [76], Dominic Cooper [35] and Andrew Hopkins [105] into our own conceptual framework. This framework emphasizes the human factor as a resource and not as a problem, changing the classical perspective, in which man was seen as the weak link in the system. We argued that, on the contrary, through involvement, recognition, and visible leadership, employee behaviors can become the foundation on which organizational security culture is built.

A.3. At the same time, we demonstrated that security must be understood not as a set of static rules, applied mechanically, but as an educational and relational process, built through positive feedback, collective involvement and visible leadership. We emphasized that only by creating an open and collaborative organizational climate, in which employees feel that they actively participate in the security process, can a sustainable transformation of organizational culture be achieved.

A.4. An original contribution consisted in the fact that we adapted the DO IT model (Define – Observe – Intervene – Test) to the specifics of the oil industry, validating it as a logical scheme for moving from theory to practice. We demonstrated, by analyzing the results, that this model can function as a pragmatic tool for implementing behavioral change, while maintaining theoretical and scientific rigor.

A.5. Finally, we argued, based on bibliographic research and the empirical data collected, that behavior-based security (BBS) represents a paradigm shift. We have shown that moving from passive compliance to organizational learning and active employee empowerment is essential for high-risk industries. This theoretical conclusion brings a new perspective on how organizations can achieve operational excellence and sustainability by transforming security from a formal obligation into a shared collective value.

A.6. We highlighted the relevance of the concept of normalization of deviance in explaining major industrial accidents and showed how it can be integrated into the analysis of risks in the analyzed industry. Thus, we provided a theoretical basis for understanding how risky behaviors come to be tolerated and perpetuated in complex organizations.

A.7. We made an important contribution by correlating behavior-based safety with theories of organizational culture. We demonstrated that it is not enough to apply observation

and feedback tools, but it is necessary to understand the dominant culture, collective norms and cultural diversity, which shape employees' receptivity to interventions.

A.8. We deepened the role of transformational leadership and participative leadership style in forming a sustainable safety culture. We theoretically argued that a leader who actively engages and serves as a model of safe behavior generates more profound change than a leader focused exclusively on control or sanction.

A.9. We proposed an interdisciplinary approach to behavioral security by integrating the perspective of organizational psychology with risk management and industrial engineering. In this way, we strengthened the multidimensional nature of the field and emphasized the importance of treating security as a complex phenomenon, located at the intersection of several disciplines.

A.10. We demonstrated, based on the literature and empirical results, that security should be conceptualized as a process of continuous organizational learning, and not as a simple compliance with norms.

## **ii. Methodological contributions**

In methodological terms, we have made important contributions by designing and implementing tools and procedures adapted to the complex specificities of the oil industry, characterized by multiculturalism, linguistic diversity and difficult working conditions.

B.1. First, we established a set of conceptual and operational criteria for identifying critical behaviors in industrial activities, structured into universal categories, but adaptable to the specifics of each industry or type of activity. These categories include wearing personal protective equipment (PPE), body position and mechanics, work planning, working at height, handling suspended loads and using cranes, avoiding lines of fire, and communication and authorizations. Each category provides examples of critical behaviors (e.g., using safety harnesses, lifting correctly by bending the knees, marking work areas, avoiding standing under suspended loads, respecting work permits), and observers can classify actions as safe or risky.

Through this conceptual framework, we were able to transform behavioral checklists from simple descriptive tools into standardized means of assessment, monitoring, and feedback, which can be used in a variety of organizational contexts. Thus, the rigorous selection of critical behaviors allowed focusing interventions on actions with a direct impact on operational security, avoiding the dispersion of resources on secondary aspects. In addition, by structuring the LVCs into general categories, we ensured the replicability and transferability of the methodology to other industries (construction, chemistry, energy, transport), demonstrating that SBC can be adapted to very different work environments, while maintaining the coherence of the observation, feedback and continuous improvement process..

B.2. Second, we designed a comparative experimental design, including a control site (E), which allowed for a rigorous assessment of the impact of the interventions. This methodological choice represented an element of originality, since in many similar studies the lack of a control group made it difficult to demonstrate causality. By comparing the evolutions of the intervention sites with those of the control group, we were able to isolate the specific effects of the SBC program and show that the changes in behaviors cannot be explained exclusively by external factors.

B.3. At the same time, we developed a data triangulation methodology – combining direct observations, interviews and questionnaires – which gave robustness to the results and reduced the risk of interpretation errors. This framework allowed for the correlation of

quantitative data (number of safe and risky behaviors observed) with qualitative data (perceptions, attitudes, level of acceptance of the program).

B.4. A distinctive element of the methodological contribution was the fact that we adapted the observation and feedback procedure to local conditions. We took into account the particularities of the work schedule, the language barriers and the operational pressures specific to each site. We thus demonstrated that SBC is not a rigid concept, but a flexible one, capable of being applied in complex multicultural contexts. We adapted the SBC methodology to the multicultural specifics of oil teams, an aspect that involved complex work of adjusting the tools and processes. In this way, we demonstrated that SBC can be successfully implemented in organizations with a heterogeneous workforce, confirming that cultural and linguistic diversity do not constitute insurmountable obstacles, but challenges that can be overcome through flexible and creative methodologies..

B.5. We proposed a phased logic of the research. Through the clarity of the stages and their direct correlation with the research objectives, the scheme also offers other researchers or practitioners a clear and transferable operational guide for implementing SBC interventions, while demonstrating that the process can be successfully applied in diverse industries, with varying levels of complexity and risk.

B.6. We proposed a replicable methodological framework for high-risk industries, built on clearly defined stages: training observers, using standardized behavioral checklists (BCLs), periodic data analysis and continuous adjustment of interventions.

Through this approach, we built a methodology that can be transposed with minimal adjustments to other sectors such as construction, chemistry or energy, confirming its transferable value. In this way, the research does not only provide a specific solution for the oil industry, but an operational model applicable in various fields where occupational safety is a strategic priority.

B.7. I developed a comparative framework for the critical analysis of the specialized literature in the field of SBC, through which I identified both convergences and differences between previous methodologies, capturing the way in which they were applied in different industries. The analysis included aspects such as the theoretical structure of the models, the implementation methods, the categories of targeted behaviors and the organizational context in which they were tested. Through this approach, I was able to highlight the degree of transferability of these methodologies to the oil industry and to identify those practices that can be effectively adapted to a multicultural environment, characterized by high risks and operational pressures. This comparative approach provided a solid foundation for the choice and adaptation of my own tools, allowing the integration of successful elements from international studies into a methodological scheme appropriate to the local specifics.

B.8. We introduced cross-cultural validation criteria for the methods and tools applied, recognizing that the effectiveness of SBC depends not only on the technical correctness of the tools, but also on the degree to which they are accepted and understood by employees from different cultural backgrounds. In this regard, we took into account the linguistic diversity, the level of functional literacy and the cultural particularities of the teams analyzed.

### **iii) Application contributions**

C.1. Contextualized implementation of interventions: In terms of application, we implemented and coordinated behavioral interventions on six industrial sites, adapting the strategies according to the specifics of each site and the cultural and organizational

particularities. At sites A and F, the emphasis was placed on individual coaching and personalized feedback, which allowed for a timely and rapid correction of risky behaviors and strengthened individual responsibility. This approach contributed to the formation of safe reflexes and the creation of a culture in which learning from practical experiences became routine.

C.2. Quantitative and qualitative results of the interventions: We empirically demonstrated that the implemented behavioral interventions led to significant increases in safe behaviors and a reduction in risky practices. At A and F, the degree of safety exceeded the 95% threshold during the testing period, confirming the effectiveness of the coaching and the constantly applied feedback. B and D recorded increases of 12–13% compared to the initial period, while risky behaviors were reduced by over 50% (for example, in B from 35.33 to 15.33, and in D from 36.83 to 16.66). These figures confirm not only the immediate positive impact of the interventions, but also the sustainability of behavioral change in the medium term.

Beyond these quantitative results, the research also highlighted important qualitative transformations.

C.3. Reinforcement through feedback, recognition and organizational multiplier effect: We particularly highlighted the effectiveness of immediate feedback and individualized coaching, which contributed decisively to reducing repeated violations and increasing personal responsibility.

Moreover, the reduction of risky behaviors by over 50% did not remain a one-off phenomenon, but generated an organizational multiplier effect. In this way, SBC had not only an immediate impact, but also a dissemination effect, contributing to the consolidation of a solid and sustainable organizational culture of security.

C.4. Impact on organizational climate and team cohesion: Another important aspect highlighted by the research was the fact that SBC did not only produce measurable behavioral changes, but also beneficial collateral effects on organizational climate.

These transformations confirm that SBC can function not only as a risk prevention tool, but also as a mechanism for organizational cohesion and development, in which security becomes a shared value and an integral part of the organizational culture.

C.5. Strategic recommendations for SBC sustainability: We contributed to the formulation of a coherent set of practical and strategic recommendations for the consolidation and integration of Behavior-Based Security programs into the organization's internal policies.

C.6. We showed that SBC programs can significantly contribute to reducing the rate of accidents and high-risk incidents, even without major investments in infrastructure or technology. The results obtained confirm that effective human resource management and modeling of observable behaviors can have a direct impact on the level of organizational security.

C.7. Am contribuit la *reconfigurarea modului în care organizațiile definesc și trăiesc securitatea muncii*, arătând că aceasta nu trebuie redusă la un set de reguli impuse de management, ci percepută ca un *proces educațional și relațional*.

C.8. We have highlighted that lessons learned at the local level can be transformed into good practices at the organizational level, through reporting, analysis and behavioral auditing mechanisms. Thus, the positive experiences and solutions identified at sites A–F did not remain isolated, but were disseminated and integrated into the organization's overall security policies. This practical application demonstrates that SBC has a scaling and transferability

effect, transforming local interventions into a general framework for action and contributing to the development of a coherent and sustainable organizational security culture.

**c. Study Limitations**

**i. Methodological Limitations**

LC.1. First, one of the major limitations of the research was related to the reliance on direct observations and self-reports. Even though standardized checklists were used and the aim was to reduce subjectivity, the perceptions of observers or respondents can be influenced by cultural, emotional or organizational factors. This aspect can generate subtle variations in the accuracy of the data collected.

LC.2. Second, the experimental design included a control group (site E), but the total number of sites was relatively small (six). This structure allowed for testing and comparing several types of interventions, but does not allow for immediate generalization of the conclusions to the entire industry.

**ii. Contextual Limitations**

LC.3. Another set of limitations derives from the specifics of the industrial and organizational environment. The oil industry has particularities that make it an extremely useful context for testing behavioral interventions, but also difficult to fully extrapolate to other areas. The multicultural environment, constant pressure on productivity, and frequent personnel changes can influence both the application of interventions and the receptivity of employees. Thus, the results obtained may not be replicable in organizations with more flexible hierarchical structures or with lower levels of operational risk.

LC.4. At the same time, time pressure and production targets were a constant constraint in the implementation of the program.

Furthermore, pressures related to deadlines, workloads and limited resources sometimes favored a prioritization of immediate efficiency at the expense of long-term safety. Although most supervisors and employees remained receptive to the program, there is a risk that in such contexts there was a temporary return to old habits or operational compromises. This finding emphasizes the need to accompany SBC interventions with continuous monitoring mechanisms and clear support from top management, so that the safety message remains constant and credible even during the most demanding production periods.

**iii. Conceptual limitations**

LC.5. From a conceptual point of view, a limitation of the study is that the emphasis was placed predominantly on the behavioral factor, without analyzing in detail its interaction with technical and organizational factors. Even though the thesis recognizes the interdependence between these dimensions, the applied methodology focused mainly on the observation and modification of employee behaviors. Therefore, the way in which technical infrastructure, workstation ergonomics, operational procedure design, or corporate policies can directly influence the results of an SBC program was not exhaustively investigated. Such an analysis could have highlighted even more clearly the contextual conditions that facilitate or, on the contrary, limit the effectiveness of behavioral interventions.

LC.6. The research also did not follow in detail the quantifiable economic impact of the interventions, such as cost-benefit analysis or calculating ROI (Return on Investment) indicators. The emphasis was mainly on the behavioral and cultural dimension, and the financial effects were only implicitly inferred through the reduction of incidents and their associated costs. This lack leaves open an important future direction of research, namely the integration of SBC into a broader economic and managerial evaluation framework, which would demonstrate not only the social and cultural value of the program, but also its strategic value for organizational sustainability and competitiveness.

#### **d. Directions for further research development**

DC.1. Extending research to other industries: A first direction of development is represented by the transferability of the model to other high-risk areas, such as construction, chemical industry, transportation or nuclear energy.

DC.2. Long-term research: Another direction is longitudinal studies, carried out over longer periods of time (two to three years). Such research could assess not only the sustainability of behavioral changes, but also how SBC interventions gradually integrate into the organizational identity and become part of collective values.

DC.3. Integration of technical and economic factors: Further developments should also aim at integrating the behavioral dimension with the technical and economic ones. In addition, evaluating the cost-benefit ratio (ROI) of SBC programs could demonstrate not only their social and human utility, but also their economic and strategic value for organizations.

DC.4. Digitalization and artificial intelligence: Another promising area is represented by the digitalization of the observation and analysis process, through the use of mobile applications, digital platforms and artificial intelligence.

DC.5. Leadership and organizational culture: Future research could investigate more deeply the role of transformational leadership and cultural diversity in the success of interventions.

DC.6. International comparative analyses: Last but not least, it is recommended to expand the research at the international level, through comparative studies between companies from different countries and organizational cultures.

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