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A REVIEW OF AN NATIONAL SAFETY AUTHORITY'S SUPERVISION ACTIVITIES & AUDIT OUTCOMES TO ENHANCE ITS MONITORING OF RAILWAY ORGANISATION SAFETY MANAGEMENT SYSTEMS



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Background

National Safety Authority

- ❑ Each European Union (EU) Member State has a National Safety Authority (NSA) for railways, established under EU legislation
- ❑ The NSA is the safety authority for railway organisations (ROs) operating in that member state
- ❑ NSA role is safety oversight and may produce guidelines for ROs to operate passenger/freight services
- ❑ Each RO provides a Safety Management System (SMS) document which the NSA assesses against Common Safety Method (CSM) regulation SMS requirements, applicable TSI's and National Rules. If satisfied, the NSA issues a single safety certificate/safety authorisation
- ❑ After certification, the NSA supervision team audits the SMS of the RO as a planned activity. NSA audit reports may include outcomes which the RO must address
 - An audit outcome included in this context of this research, was either a **non-compliance** or **action required** type as defined by the NSA-IE supervision process

Safety regulation of railways

❑ European legislation

- Recast Railway Safety Directive (RSD) 2016 of the RSD 2004
 - Sets out the NSA role for each EU member state
 - Defines Infrastructure Manager (IM) and Railway Undertaking (RU) organisations and what should be in an SMS
- Technical Specifications for Interoperability (TSIs)
 - Defines technical and operational standards which must be met by each subsystem, in order to meet the essential requirements, to ensure interoperability of the railway system of the EU
- 2018 CSM Regulations
 - Provides new requirements for SMS conformity assessment & supervision. E.g. introduces a new requirement for the National Safety Authority (NSA) to publish decision making criteria for how it evaluates the effectiveness of an SMS

❑ National Legislation in Ireland

- Railway Safety Act (RSA) 2005 Act
 - Establishes the Commission for Railway Regulation (CRR) as NSA for railways
 - Sets out that any Railway Organisation (RO) as defined in RSA 2005 Act or amendments, must have an SMS document to safely operate
- Statutory Instrument (SI) 476 of 2020
 - Transposes the Recast RSD 2016 into national legislation
 - Introduces additional requirements making Human Factors and Safety Culture (SC) part of the SMS.
 - Introduces the new Single Safety Certificate
 - Ensures continued application of the requirements in the CSMs and TSIs

Problem & Research approach

Problem

❑ The NSA is required by new legislation to analyse its audit outcomes to develop a risk-based approach to supervision

- The main problem is that the NSA does not have a formal methodology to analyse its audit outcomes
- This task had not been undertaken previously due to not being deemed a priority
- Time and resources in a small NSA to undertake such work is an issue

❑ Motivation for the work

- This study was motivated by the new legislation changes, the impact it will have on the NSA planning priorities and new competences required for NSA staff
- This study will assist and benefit the NSA in identifying potential deficiencies associated with the SMS of a RO
- My dissertation provided a means to do this work, which also motivated this study
- This work should enhance the monitoring of a railway organisations' SMS by the NSA by making recommendations on how to achieve this
- Another motivating factor is previous audit outcomes are required as one of the inputs to be collected and analysed for implementing risk-based supervision as defined in the new CSM Regulation. There are other inputs for risk-based supervision in the new CSM Regulation but are not part of this work

Research approach

1. To provide an overview of the implication on NSA supervision activities of the introduction of new Common Safety Methods (CSM) regulations/legislation

- To look into a broadly accepted approach to measure/indicate if an SMS is effective
- To review current practices and studies linking SMS with SC

2. To undertake a data analysis of the NSA audit outcomes from the NSA audit reports of railway organisations' SMS

- This required the author to devise a methodology for the data analysis
- This research involved reviewing over 500 audit outcomes from 60 NSA supervision audits over the period 2012 to 2019
- To undertake an effective analysis of NSA audit outcomes requires
 - A good overall knowledge of the CSM criteria for an SMS
 - Assignment of every NSA audit outcome to a CSM criterion
 - Good judgement and consistency in approach

Aim and objectives

Aim

To provide recommendations to enhance the National Safety Authority (NSA) planning process for monitoring a railway organisations' Safety Management System (SMS)

Objectives

1. To provide an overview of the impact on NSA supervision activities of the introduction of new Common Safety Methods (CSM) regulations/legislation
 - To identify a broadly accepted approach to measure/indicate if an SMS is effective
 - To review current practices and studies linking SMS with SC
2. To undertake a data analysis of the NSA audit outcomes from the audit reports of several railway organisations' SMS

Findings

Objective 1: Impact of new legislation findings

❑ **New EU legislation has additional mandatory requirements to take account of**

- Evaluating SMS effectiveness by the NSA
- Safety culture (SC) in the RO's SMS

❑ **Impact on small NSA is how to manage additional supervisory duties**

- Requires the NSA to build and develop new competences
- Requires a strategic planning priority to be devised by NSA for the additional workload as resources are an limited
- The NSA must develop risk-based planning approach to supervision
- Takes time to develop new staff competences for the ERA Management Maturity Model (MMM) and SC tasks
- The NSA needs time and resources to produce guidelines for the rail sector and for any new decision making criteria procedures for evaluating SMS effectiveness

Objective 1: Literature review findings - researching the approaches to evaluate the effectiveness of an SMS found some differing author's views

- ❑ Evaluating SMS effectiveness would require the combination of a compliance activities and a performance evaluation¹
- ❑ ERA have produced a Management Maturity Model (MMM) tool to evaluate the effectiveness of an SMS²
- ❑ Performance indicators can be used to check for SMS effectiveness³
- ❑ Performing a safety perception survey can provide a indicator for SMS effectiveness⁴
- ❑ Aviation sector in the USA developed a tool for checking the overall SMS effectiveness, which is a function of both compliance and performance indicators⁵
- ❑ Aviation sector in Europe uses performance based approach for checking SMS effectiveness⁶
- ❑ There are three main approaches to measure SMS performance, results-based, compliance-based & process-based approaches. Each approach will result in producing the effectiveness of the SMS⁷

1-Li Y., Guldenmund F.W. (2018) Safety management systems: A broad overview of the literature

2-EUAR (2018) European Agency for Railways. Guidance for safety certification and supervision, Supervision guide. Guidance for safety certification and supervision, Management Maturity Model.

3-Chen W., Li, J. (2016). Safety performance monitoring and measurement of civil aviation unit

4-Carder B., Ragan P.W. (2002) A survey-based system for safety measurement and improvement

5-Stolzer, A. J., Friend, M. A., Truong, D., Tuccio, W. A., & Aguiar, M. (2018). Measuring and evaluating safety management system effectiveness using Data Envelopment Analysis.

6-EASA (2016), Practices for risk-based oversight, European Aviation Safety Agency

7-Cambon J., Guarnieri F., Groeneweg J.(2006) Towards a new tool for measuring Safety Management Systems performance

Objective 1: Literature review findings - studies linking SMS with SC

- ❑ A study found that a safety perception survey can be used to check safety culture of an organisation, which is linked to checking the effectiveness of an SMS
 - ❑ ERA have produced a safety culture model for the rail sector¹
 - ❑ An aviation sector related study claims to have developed a tool to measure safety culture²
 - ❑ Surveys and interviews were used to assess the safety culture of a railway maintenance organisation³
 - ❑ Another study reviewed using maturity models for an organisation's safety culture assessment and found the results to be inconclusive for reliability, validity and robustness⁴
- ❑ **In addition, the author found three published studies on railway investigation reports, which identified the factors of the CSM criteria related to the causes of accidents⁵. In the limited literature found, they all correlated that most problematic areas of the SMS were**
- Risk management i.e. CSM criterion A, and,
 - Competence management i.e. CSM criterion N

1-Rolina G., Accou B. (2018) Evaluate to Learn and Improve: A Safety Culture Model for European Railways, International Railway Safety Council

2-Piers M., Montijn C., Balk A. (2009) Dutch National Aerospace Laboratory (NLR) Safety Management System and Safety Culture Working Group

3-Farrington-Darby, T., Pickup, L., & Wilson, J. R. (2005). Safety culture in railway maintenance

4-Goncalves Filho, A. P., & Waterson, P. (2018). Maturity models and safety culture: A critical review

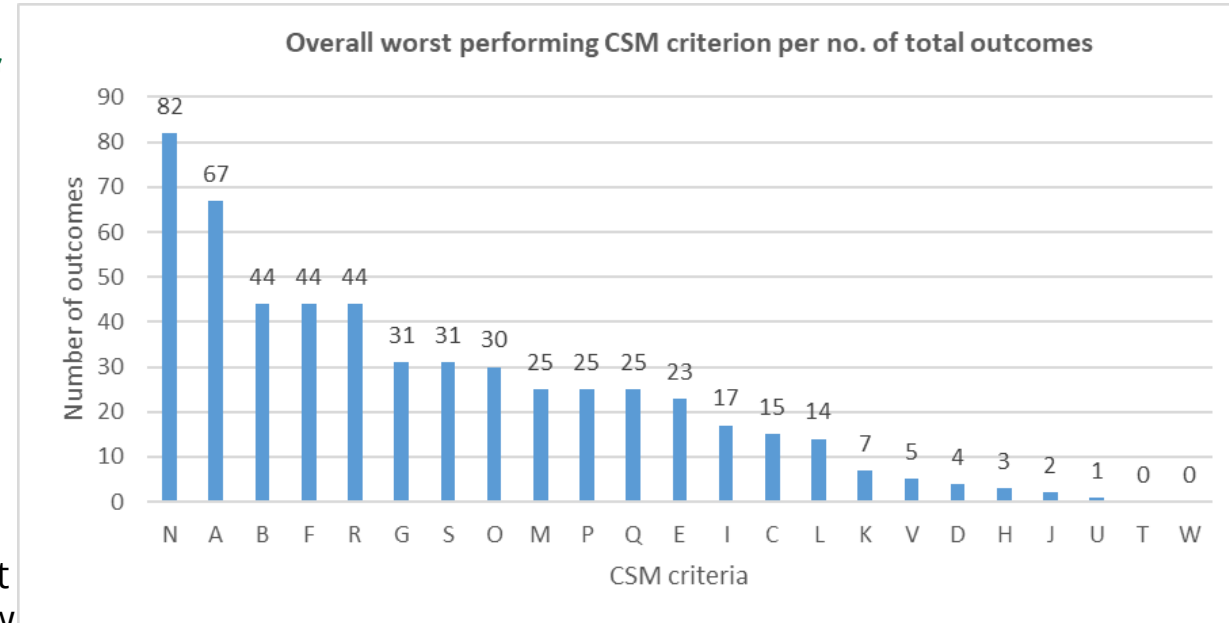
5-Wu et al. (2017), French and Steel (2017), Fox (2009)

Objective 2: Data analysis findings

❑ **The CSM criteria found with the highest quantity of non-compliances and action required audit outcomes against a RO's SMS, in descending order were**

1. N - Competence management,
2. A - Risk management,
3. B - Maintenance management risks, F - Distribution of responsibilities and R - Emergency management,
4. G - Management control, S - Internal audit of SMS,
5. O - Information provision - Internal.

❑ The findings and methodology for the data analysis of audit outcomes by the author, was also found to partly satisfy a new CSM regulation requirement for NSA supervision. This approach could possibly provide for one of the inputs required and would enhance the NSA supervision planning process making it a risk based approach.



Recommendations

Objective 1: To give an overview of the impact on NSA activities of the introduction of new Common Safety Methods (CSM) regulations/legislation:

Findings

- The NSA being small in size i.e., with limited resources and competence, will have to do a review of the implications of the additional workload from the new CSM regulations covering SMS effectiveness and SC. A risk-based planning approach will be required to be developed by the NSA.
- The NSA may have to provide additional training and procedures to staff and may need to produce guidelines for the railway sector for:
 - Evaluating the SMS effectiveness of an RO, using the ERA MMM tool and for;
 - Assessment and supervision of SC in a RO's SMS.

Recommendations

The NSA should develop a new strategy plan to address the new CSM regulation for NSA supervision to ensure they can meet these new requirements.

It is additionally recommended the NSA should consider in its strategy, the new mandatory requirements for human and organisational factors (HOF), which must be part of the RO's SMS. It was not feasible in the time required for this study for HOF to be included.

Objective 1: Is there a broadly accepted approach to measure/indicate if an SMS is effective:

Findings

- Differing views were found in the literature review on what checking the SMS for effectiveness means, and this could inevitably decide the approach used.
- It was found that approaches to measure/indicate if an SMS is effective, are only beginning to be used in the railway sector, apart from the UK¹, while the aviation sector was found to be at a more advanced stage.
- ERA have developed a Management Maturity Model (MMM) tool for evaluating the effectiveness of an SMS for the rail sector, but only 2 out of 27 EU Member states were found to be applying it in 2021. Further research is needed to understand the low usage of the MMM tool.

Recommendation

The NSA should start to implement the ERA MMM tool, as the tool will meet the new CSM regulation requirements for NSA supervision. The NSA will have to add a timescale for completion of this task within its planning schedule.

As a backup solution, the NSA should be made aware that a safety perception survey can be used to check SMS effectiveness². This may be another option for the NSA to possibly explore if it has the time to do so, and if implementation of the ERA MMM tool is unsuccessful.

1- UK rail sector using Risk Management Maturity Model (RM3) since 2011

2- Carder B., Ragan P.W. (2002) A survey-based system for safety measurement and improvement

Objective 1: Review current practices and studies linking SMS with SC:

Findings

- The author found differing approaches to assess safety culture in organisations.
- From the limited published literature found a safety culture assessment using safety perception survey using independent specialists indicated a favourable result.

Recommendation

The author recommends a safety perception survey is facilitated and implemented by the NSA to assess the Safety Culture of an organisations SMS. The NSA is appropriately independent of the RO to do the survey analysis. In order to ensure the survey gives a fair representation of the organisation, agreements in advance of the survey should be considered i.e., regarding participation and ensuring anonymity of participants. The actual survey questionnaire may need to be devised from specialists external to the NSA. Time and resources for this activity will need to be considered by the NSA in its planning priorities.

Objective 2: To undertake a data analysis of the NSA outcomes from the audit reports of railway organisations' SMS:

Findings

- The data analysis of NSA audit outcomes found SMS CSM criteria N - Competence management and A - Risk management to have the highest frequency of non-compliance/ action required.
- Three studies¹ found during the literature review, had reviewed railway investigation reports and linked the causations to factors/elements of the SMS. They found competence management and risk management as the most problematic areas of the SMS.

Recommendation

It is recommended to the NSA should it apply a risk based approach, to ensure that the CSM criteria listed below, are prioritised for audits as a minimum, over a periodic basis for every RO.

1. **N - Competence management,**
2. **A - Risk management,**
3. **B - Maintenance management risks, F - Distribution of responsibilities, R - Emergency management,**
4. **G - Management control, S - Internal audit of SMS,**
5. **O - Information provision – Internal.**

Additionally, the NSA and wider audience should take note of the findings above which correlate, that competence management and risk management were the most problematic areas found with the SMS.

1-Wu et al. (2017), French and Steel (2017), Fox (2009)

Objective 2: To undertake a data analysis of the NSA outcomes from the audit reports of railway organisations' SMS

Additional Finding

- The findings and methodology devised by the author for the data analysis of audit outcomes was also found to partly satisfy a new CSM regulation requirement for NSA supervision. This will enhance the NSA supervision planning process making it a risk based approach.

Recommendation

It is recommended that the NSA supervision planning process should utilise the findings and methodology devised by the author in this study as the basis of an input into the supervision strategy and plan. This will aid the NSA to align its processes with a new CSM regulation requirement for NSA supervision.

Thank you for your attention/Gracias por su atención



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