EUROPEAN UNION AGENCY FOR RAILWAYS

Making the railway system
work better for society.

Full Impact Assessment

Common safety methods for assessing the safety level and the safety performance of railway operators at national and Union level

Contents

1. Context and problem definition

1.1. Problem and problem drivers

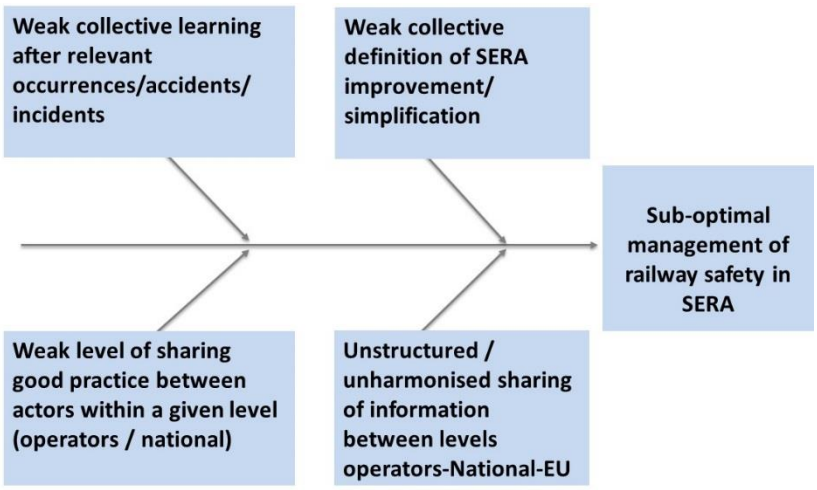
A number of challenges to objectively estimate/benchmark the safety level and safety performance of single operator(s) in SERA remain:

- *As part of the general safety oversight by the authorities and the public*
- *Poor learning from own safety performance and that of others*

More specifically, in relation to established Common Safety Methods (CSMs), in order of ability to control the risk these challenges manifest through:

- *SMS monitoring*
- *Supervision*
- *Safety certification (renewal) process*
- *View on the developments of safety within the SERA*

These challenges are partly linked to the limited ability to access, manage and use optimally information about accidents and incidents including causes, precursors, risks and trends as well as the management of risk control measures. These elements were highlighted in the CSM ASLP Mandate where it was stressed that '*…the collection and sharing of safety occurrence data… could be enhanced providing more safety details related to the causes of the occurrences. To fully exploit this information, it is important that the collected data are comparable, so that the railway operators can draw benefit from it in their assessments and analysis*. The overarching problem would then be the sub-optimal management of railway safety in SERA at operator, national and EU levels having implications on the overall level of railway safety in Europe as well as operational performance. In particular, four main drivers of this problem have been identified, as displayed below:



	1. Weak collective learning[1] after relevant occurrences / accidents/ incidents This refers to several underpinning factors: 1) collection of occurrences and related elements (e.g. on causes, influencing factors and risk control measures) is not optimal (with differences in terms of what is collected / measured incl. level of aggregation); 2) variations in data quality assurance and validation; 3) constrained accessibility and availability of relevant information on accidents; 4) limited use of data analytics to enhance the understanding of safety developments. Moreover, the actual investigation practice of individual operators is not deep enough to lead towards sustainable improvement. Insufficient realising of collective learning potential within the field of railway safety implies a sub-optimum outcome for the sector as a whole either materialising in lower than possible efficiency in operations or lower than possible effectiveness re. the resulting safety performance. *Practical example:* The Agency's most recent analysis of the NSAs Annual reports from 2020 highlights that *'…in some cases no in-depth analysis of data was made and consequently no analysis of trends of CSIs and of national safety indicators was provided'*. *2. Weak collective definition of SERA improvement / simplification* Barriers regarding access, management and use of safety data (occurrences) and information related to the SMSs are limiting the extent to which stakeholders can identify, analyse and prioritise elements / actions for SERA improvement / simplification. In particular, this is an issue facing the Agency where a main data source is the CSIs (although these are at aggregated national level and therefore do not facilitate analyses at lower levels). A similar information asymmetry would also be a concern for NSAs with particular reference to ensuring sufficient (and comparable) information as inputs for prioritizing and planning their supervision activities. As highlighted in Annex EcoEv 0 on collective learning potentials, improving the conditions for tapping into shared knowledge could stimulate system level improvements that are not used today. *Practical example*: For the Agency the annual assessment of achievement of CSTs provides a high level picture of the evolution of safety in SERA. However, without more detailed inputs it is difficult to pinpoint the reasons for probable or possible deterioration of safety performance.

[1] Annex EcoEv 0 provides an overview of the concept of collective learning, its relevance for the CSM ASLP and recent studies showing the potential offered by this form of learning. The literature review highlights that individual learning within a collective is included in collective learning.

	3. Weak level of sharing good practice between actors within a given level (operators / national) This would be influenced by several factors incl. the lack of harmonisation of what data are collected about occurrences and information related to the SMS, e.g. different operators are not collecting the same data (with the CSM for Monitoring not prescribing any reference list for the quantitative and qualitative indicators to be collected by RUs and IMs). Furthermore, there would, for the operator layer in particular, be sharing barriers due to confidentiality issues. In addition, the weak level of sharing of good practice is also influenced by differing depth of (accident) investigations and type of findings collected /reported. *Practical example:* Accident investigation reports from National Investigation Bodies are to date written in different formats and with differing depth of analysis as well as only limited parts provided in English. This hinders sharing both within a given level (among NIBs) as well as between levels. Hopefully, the implementation of Commission Implementing Regulation (EU) 2020/572 on the reporting structure to be followed for railway accident and incident investigation reports, developed in application of Article 24 (2) of Directive (EU) 2016/798, will facilitate further standardization. *4. Unstructured / unharmonised sharing of information between operators-National-EU* Although some provisions are in place for sharing between levels (e.g. Annex I in the Safety Directive concerning CSIs, JNS procedure, SIS) there is scope for further progress to promote a more structured / harmonized sharing. As such, the CSI provide a stable basis for getting a high-level picture of ongoing trends in safety for the EU railway system. However, these data are aggregated at a yearly level without providing specifics per accident / incident. *Practical example:* A comprehensive review of national occurrence reporting systems in Europe from 2015 (DNV, 2015) highlighted a number of cases where systematic data collection was limited to the CSIs as well as no country database for accidents being available. This is clearly limiting any extent of sharing of information. For example, in the case of one country it was stated that no database existed. Overall, there is compelling evidence regarding the importance of robust incident reporting in order to facilitate learning and effectively prevent future accidents (see e.g. Jones et al. 1999 & Lanne et al. 2006)[2]. This refers particularly to reporting of near-misses which could

[2] Jones, S., C. Kirchsteiger and W. Bjerke (1999), "The importance of near miss reporting to further improve safety performance". Journal of Loss Prevention in the Process Industries, Vol. 12, pp. 59-67. Lanne, M., M. Murtonen, M. Nissilä, K. Ruuhilehto and K. Virolainen (2006), Opas vaaratilanneraportoinnin kehittämiseen ja arviointiin (Guidance on development and assessment of incident reporting) VTT, Tampere.

<table>
<tr><td></td><td>enable improved understanding of the underpinning causes concerning incidents and accidents. A comprehensive overview of key issues and challenges of incident reporting (incl. in international contexts) that are necessary to be addressed in order to facilitate sharing and fully capture the potential benefits is provided in Johnson (2003)[3].

It should be noted that the order of magnitude of the problem and the associated problem drivers experienced by Member States will vary. In particular, for MSs already having comprehensive national systems for reporting occurrences and collecting structured information on the SMS the extent of the problem would be more limited.</td></tr>
<tr><td>1.2. Main assumptions</td><td>The problem identified in Section 1.1 is delimited by:

• Mandate given to the Agency to draft common safety methods for assessing the safety level and the safety performance of railway operators at national and Union level (Commission Implementing Decision)
• Big Picture report concerning the development of the Common Safety Methods on the Assessment of the Safety Level and Safety Performance of Operators at National and Union level

The current impact assessment builds on and uses as far as possible information already collected and analysed in the context of the Common Occurrence Reporting (COR) programme. In particular, this is of relevance for the elements of the CSM ASLP that concern simple and detailed reporting. For other parts of the CSM ASLP (e.g. reporting on risk control measures and operator self-assessment) additional information sources were required.</td></tr>
<tr><td>1.3. Stakeholders affected</td><td>The relevance of the problem is scored from 1-low to 5-high for each of the categories of relevant stakeholders. Based on the information provided in the Big Picture report, the following stakeholders are most impacted by the identified problem and problem drivers. This scoring is used later on in the impact assessment to determine which stakeholders to examine more in-depth regarding how the CSM ASLP recommendation could impact the main stakeholders positively / negatively.

<table>
<tr><th>Category of stakeholder</th><th>Importance of the problem</th></tr>
<tr><td>Railway undertakings (RUs)</td><td>5

For RUs a relative high importance score overall regarding the identified problem. As such learning systematically from accidents / incidents requires access to relevant information notably for low frequency high consequences</td></tr>
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http://www.vtt.fi/inf/julkaisut/muut/2006/opas_vaaratilanneraportointi.pdf.

[3] Johnson, C. (2003) Failure in safety-critical systems: A Handbook of Incident and Accident Reporting, Glasgow University Press

		risks which cannot be sufficiently well identified and monitored within a single RU. In particular, this would be relevant for small RUs / new entrants for whom there could be limited internal safety data on occurrences including underlying causes, other influencing factors and efficient risk control measures. Equally, those RUs having not yet fully implemented a risk-based approach for their management of safety may experience challenges in terms of optimizing risk control measures and continuous improvement.
	Infrastructure managers (IMs)	5 For IMs the described problem is of relative high importance with particular reference to learning from accidents / incidents in terms causes as well as determining whether risk control measures are sufficient. Lack of comparable information would be particular relevant for those IMs managing and operating relative small networks. Moreover, the problem would also be present for those IMs having not yet fully implemented a risk-based approach to safety management. Ongoing work and cooperation among infrastructure managers to determine safety related trends are relevant elements for mitigating the impact of the problem (e.g. PRIME)
	Railway manufacturers	3 Railway manufacturers are less directly impacted by the problems outlined above. Key issues would be linked to technical failures of railway subsystems as well as implications on rolling stock design (incl. passive safety measures) and interfaces with infrastructure. A particular issue of increased importance is railway manufacturers' involvement in providing maintenance services to RUs throughout the life cycle of rolling stock. In this case, lack of access to reliable

		information of operations including safety occurrences would be an issue.
	Other railway sector stakeholders (notably ECMs)	3 A lower score for stakeholders in this category compared to RUs / IMs. ECMs and other railway sector stakeholders are influenced by the problem(s) outlined albeit at a relative lower level. In particular, ECMs may be concerned to the extent that occurrences can be linked to the arrangements regarding maintenance of vehicles and how RUs are managing their ECMs.
	National Safety Authorities / TDG Competent Authorities	4 Challenges for accessing systematically safety-related data represent a significant problem for NSAs (and TDG Competent Authorities). This could have an impact on how the NSAs perform their supervision activities, e.g. by limiting the available information basis for planning and prioritizing areas to focus on in terms of operators and their application of the safety management systems.
	Agency	5 The outlined problem has a high importance for the Agency. In particular, this would be in relation to single safety certification and follow-up as well as monitoring of NSAs and related stakeholders along with identifying areas of improvement re. safety of SERA. For the moment the Agency has limited access to disaggregated information about safety occurrences (incl. causes), underlying trends in risks / risk profiles and the extent to which risks are controlled.

	It should be noted that the importance scores reflect averages such that variations within stakeholder groups are present. For example, there exist today railway operators and countries for which occurrence reporting and learning from accidents / incidents are comprehensive and goes well beyond the requirements established through the Railway Safety Directive and related legislation (e.g. CSM Monitoring). In these cases the problem outlined earlier would be less significant.
1.4. Evidence and magnitude of the problem	A range of information sources are used to provide evidence concerning the further analysis of the problem and the magnitude of the problem. These include: • *Information and analyses provided by CSM ASLP WP participants in WP meetings incl. a series of bilateral meetings / discussions* • *Findings and experiences from CER / EIM testing of applying draft CSM ASLP annexes for reporting events, occurrence scenarios and risk control measures.* • *Information and reports collected in the Common Occurrence Reporting project* • *DNV study on occurrence reporting, in particular Report on Task 3 – Impact Assessment (2015)* • *Other EU rail specific studies linked to occurrence reporting and maturity assessment* • *Studies undertaken for railway systems outside Europe* • *Studies examining similar issues for other transport modes* • *Studies examining similar issues for other economic sectors (notably safety-critical industries)* Of particular importance for the CSM ASLP Impact Assessment the Agency's report on Return of Experience for the CSM for Monitoring (from 2017) highlighted that[4]: • *A large number of stakeholders across the EU (usually more familiar with the application of rules rather than with risk management), RUs, ECMs and a few IMs, **still face difficulties in understanding and correctly implementing the method**.* • *In addition, the study also indicated that '…In general, almost all stakeholders (RUs, IMs and ECMs) perceive the CSM for monitoring only as a legal obligation. Although exceptions can be found (e.g. ECMs), usually the stakeholder maturity with the risk management and management system concepts is not yet at a level where they **would use the monitoring as an active tool for optimising the company costs and competitiveness**. This shows an immature and insufficient stakeholders' awareness of the importance of an effective monitoring system'.*

[4] The report is available on the Agency's website: https://www.era.europa.eu/sites/default/files/activities/docs/report_on_return_of_experience_on_csm_for_monitoring_en.pdf

	• *Moreover, it was found that '…In general,* ***there is a lack of sharing of knowledge and experience*** *(also) on the CSM for monitoring among the stakeholders because they compete with each other'.* These issues are confirmed in the Agency's qualitative analysis of the 2017 NSA Annual Reports where it is mentioned that there *'…is, however, a need to continue making railway operator aware of the need to adopt a structured and effective system for monitoring safety process and performance in full compliance with Regulation (EU) 1078/2012 …'* (ERA, 2020). It was though noted that an improvement has been registered re. *'…the monitoring procedures into the SMS but there is still room for improvement so that the actions better respond to the strategies formalised'*. The Agency's report on the 2017 NSA Annual Reports includes also findings re. the NSAs supervision activities. In particular, it was found that a number of authorities did not have a specific supervision strategy. Moreover, although several NSAs referred to a supervision plan it was not clear in all cases the sources and the underpinning basis for it. This could suggest the potential lack of reliable and effective in-depth information on risk profiles for the operators present in a number of MSs. Key points mentioned in the COR IA report as part of the problem statement are recalled for information as these points to areas of relevance to the CSM ASLP (although this recommendation is broader in scope than the COR): 1. There are currently **a variety of approaches between the EU Member States concerning the scope and extent of national reporting.** According to the DNV study: › *11 Member States had a basic occurrence reporting regime[5],* › *8 Member States had intermediate occurrence reporting regime[6],* › *while 10 Member States had comprehensive occurrence reporting regime[7]* *Implication:* This shows that different approaches are in place across Europe re. the extent of occurrence reporting and could indicate that sub-optimal levels have been adopted.

[5] National Occurrence Reporting is largely confined in scope to the reporting requirements of the Common Safety Indicators and the need to notify the NIB of significant accidents.

[6] National Occurrence Reporting goes beyond EU legal minimum requirements of the Common Safety Indicators and the need to notify the NIB of significant accidents, but is either not fully comprehensive or not clearly part of a wider process to turn occurrence reporting into information and then mitigating action.

[7] The national occurrence system extends into a comprehensive system for reporting accidents, incidents, and near misses. It is a part of a defined process for turning data into information and then subsequent mitigating action as part of a holistic approach to the management of railway safety at the Member State level.

	2. The available CSI information shows that **the ratio between the total number of precursors and total number of significant accidents is not stable** Implication: Although, there would normally be some variation in this ratio, the instability suggests possible different understandings / practices about what is to be reported as precursors. 3. **Investigated occurrences represent a fraction of the total number of significant accidents and accident precursors**. On average the National Investigation Bodies (NIBs) investigate some 10% of the CSI significant accidents, albeit with substantial country differences and variations in terms of what accidents are investigated. Implication: Accident investigation practices vary across countries which could mean that lessons from occurrences are not fully explored. Several railway-related studies point to the possible advantages of enhanced near-miss reporting in order to enable prevention of accidents linked to the common cause hypothesis (CCH). For example, Wright (2002) explores this issue with reference to the UK railway sector looking at 200+ incidents for one railway company. The study provides evidence on the relevance of near-miss reporting. Further analyses building on this work has been carried out in relation to railways in the Netherlands, see e.g. Van der Schaaf & Wright (2003). Further UK analyses point towards improved railway safety through the implementation of a confidential incident reporting and analysis system (CIRAS). In particular, CIRAS reports about health and safety concerns and then facilitates a resolution between the individual and the relevant company or companies. CIRAS is not limited to railways but cover also other modes. In the case of railways, there were between 2008 and 2012 2228 (rail related) reports received by CIRAS; 45% of these resulted in tangible safety improvements and approximately 33% contained important information about safety that was new to the company concerned (Davies, 2014). Evidence from US railways demonstrates the potential importance of having confidential close call reporting systems in place (illustrated by the C3RS system introduced by the Federal Rail Administration). For example, a before-after study suggests a possible significant reduction (50%) in derailment rates per annum caused by run through switches (FRA, 2013). Evidence from **other sectors** was collected as part of the COR IA work may also have some relevance for the CSM ASLP (even though it is recognised that studies from other sectors may not be fully transferable to the railway sector) : • ***Aviation:*** *Available evidence points to the possibility that an integrated data-driven strategy for improving safety performance can lead to lower safety-related costs of more than 70% as mentioned in the European Commission's Impact Assessment on occurrence reporting in civil aviation from 2012.*

	• ***Nuclear:*** *IAEA (2005)[8] concluded that '…nuclear power plants increase the use of feedback from low level events in their day-to-day activities, as this is an important contributor in improving safety performance'.* • ***Mining:*** *Ekevall, Gillespie and Riege (2008)[9] highlighted that '…safety performance in the Australian mining industry has now stabilised above the target of zero harm. Further progress will require tools that are adapted to contemporary decision-making needs that greater excellence in safety reporting is the first step on this journey'.* • ***Health care:*** *Simon, Lee, Cooke and Lorenzetti (2005)[10] concluded that '…Incident reporting (including near misses) can provide valuable qualitative and quantitative data relevant to incidents and adverse events, which in turn can potentially guide organizational and clinical interventions to decrease risks'* The stated core problem '*sub-optimal management of railway safety in SERA*' is closely linked to the requirements for continuous improvement with particular focus on safety management systems / quality management systems. A key element in this is to determine how each organisation can improve in terms of efficiency and effectiveness vis-à-vis its operations. As such this perspective requires measurement tools in order to determine improvement potentials. Therefore, the expanding literature concerning maturity modelling has also been considered as part of the analysis. Wolniak (2019)[11] offers a recent overview, incl. the possible complementary role that self-assessment can play alongside external audits in order to measure maturity. Further details and overview on self-assessments as a tool are provided in Wiele et al. (1995)[12].
1.5. Baseline scenario	The likelihood that the problem would persist if no action is taken is considered to be relative high. In particular, if no action is taken there could be a missed opportunity to facilitate improved sharing and learning regarding the management of safety risks and the occurrences of accidents and incidents for better informed decision making within SERA at all levels.

[8] International Atomic Energy Agency (2005) Trending of low level events and near misses to enhance safety performance in nuclear power plants, IAEA report: IAEA-TECDOC-1477. http://www-pub.iaea.org/MTCD/publications/PDF/te_1477_web.pdf

[9] Ekevall, E., Gillespie, B. and Riege, L. (2008) Improving safety performance in the Australian mining industry through enhanced reporting, PWC report, (https://www.pwc.com/gx/en/energy-utilities-mining/pdf/safetypaper_english_final.pdf).

[10] Simon, A., Lee, R.C., Cooke, D.L. and Lorenzetti, D. (2005) Institutional Medical Incident Medical Reporting Systems: A Review, Health Technology Assessment Unit, Alberta Heritage Foundation for Medical Research, HTA report series no. 17. http://www.ihe.ca/documents/HTA-FR17.pdf

[11] Wolniak, R. (2019) The Level of Maturity of Quality Management Systems in Poland—Results of Empirical Research, Sustainability, 11, 4239, 1-17. https://www.mdpi.com/2071-1050/11/15/4239/pdf

[12] Wiele, T. et al. (1995) State-of-the-art study onself-assessment. TQM Mag. 4, 13‑17.

1.6. Subsidiarity and proportionality	The identified problems would be cumbersome to address efficiently and effectively **by Member States alone** since this would require each Member State to conclude bilateral agreements with all other Member States leading to increased complexity and administrative burden. **Self-regulation** would neither be a feasible approach due to the potential significant administrative burden linked to the required coordination effort as well as reluctance regarding sharing information between different (commercial) entities in the railway sector. **EU action** is likely to address better the identified problems by reducing the burden of coordination (multilateral rather than bilateral arrangements) as well as minimizing the problem linked to lack of willingness to share information by bringing in an independent party. The **Agency** in cooperation with the railway sector is well positioned to address the problem in view of developing a common approach to safety in accordance with the Agency Regulation and the Safety Directive. The problem will be addressed in full respect of the **proportionality principle**, attempting to identify the optimal level of information which is subject to harmonised reporting for operators, as well as the optimal setting/architecture for exchanging the information.

2. Objectives

2.1. Strategic and specific objectives	**The strategic objective(s) of the Agency** with which this initiative is coherent: ☒ Europe becoming the world leader in railway safety ☐ Promoting rail transport to enhance its market share ☒ Improving the efficiency and coherence of the railway legal framework ☐ Optimising the Agency's capabilities ☒ Transparency, monitoring and evaluation ☒ Improve economic efficiency and societal benefits in railways ☐ Fostering the Agency's reputation in the world It should be stressed that the above listed objectives are defined at Agency level where the ones ticked are those considered of most relevance for the CSM ASLP. **General objective:** Improve the management of railway safety in SERA and thereby the overall safety level **Specific objectives (SOs):** • *SO1: Contribute towards improving collective learning after relevant occurrences/accidents/incidents* • *SO2: Improve collective definition of SERA improvement/ simplification* • *SO3: Improve level of sharing good practice between actors within a given level (operators / national)* • *SO4: Enhance structured / harmonised sharing of information between levels operators-National-EU* It should be noted that the interpretation of collective learning as used here as an objective is encompassing learning by single operators and other entities including by departments and individual staff. This emphasizes that any learning that takes place within the CSM ASLP should be placed in the context of learning already taking place at national and operator levels. A key issue to tackle within the CSM ASLP will then be to ensure that interfaces between the different levels of learning are optimized. An overview of the concept of collective learning is provided in **Annex EcoEv 0** highlighting two elements: 1) the broad and flexible interpretation of collective learning; 2) the increased realisation of the importance of collective learning on all levels of society / economy.

	Notably, individual learning within collectives is part of the collective learning process.
2.2. Link with Railway Indicators	N/A

3. Options

3.1. List of options

The impact assessment is formed around an examination of the following elements of the CSM ASLP recommendation:

- *Simple reporting of events*
- *Detailed reporting of events*
- *Railway operators' self-assessment*
- *Reporting on occurrence scenarios and RCMs*
- *Safety level assessment (SL)*
- *Safety performance assessment (SP)*
- *Group of Analysts (GoA)*
- *Information Sharing System (ISS)*

For each of these elements a number of options are identified as outlined below. It should be noted that for some elements only 2 options are considered (do-nothing vs. 1 do-something = CSM ASLP proposal)

a) Simple reporting of events

Option	*Name*
0	As of today – no change
1	Reporting restricted to significant consequence events
2	Reporting for Category A and Category B events
3	Reporting for significant consequence events + selected additional events
3*	Reporting for significant consequence events, all accidents with consequence above 5000 euros, all Category B events

b) Detailed reporting of events

Option	*Name*
0	As of today – no change
1	Reporting restricted to significant consequence events
2	Reporting for Category A events
3	Reporting for significant consequence events + selected additional events
3*	Reporting for significant consequence events only

c) Railway operators' self-assessment

Option	*Name*
0	As of today – no change
1	Self-assessment is voluntary
2	Self-assessment is mandatory

d) Reporting on occurrence scenarios and RCMs

Option	*Name*
0	As of today – no change
1	Reporting restricted to significant consequence events with part of the RCM information voluntary
2	Reporting restricted to significant consequence events with all RCM information mandatory

e) Safety level assessment (SL)

Option	*Name*
0	As of today – no change
1	As per CSM ASLP recommendation

f) Safety performance assessment (SP)

Option	*Name*
0	As of today – no change
1	As per CSM ASLP recommendation

g) Group of Analysts (GoA)

Option	*Name*
0	As of today – no change
1	As per CSM ASLP recommendation

h) Information Sharing System (ISS)

Option	*Name*
0	As of today – no change

	<table><tr><td>1</td><td>Simple IT solution to reflect restrictive scope of reporting</td></tr><tr><td>2</td><td>Scalable IT solution to start from restrictive scope of reporting and then upgrade</td></tr></table> These elements have been selected in order to capture key elements of the CSM ASLP which influence variations in costs and benefits. The disaggregated analysis allows for consideration to all the elements included in the CSM ASLP with particular emphasis on highlighting where there are potential significant choices re. the specification. The options for each element do not explicitly include a gradual step-by-step approach although it would be possible to consider a longer / shorter trajectory (e.g. starting with limited level of reporting and gradually expand the scope). This approach would correspond well to the foreseen phased implementation of the CSM
3.2. Description of options	Each of the elements of the CSM ASLP are set out below emphasizing possible different options **a) Simple reporting** O1: Simple reporting of events according to the provisions in Article 4 and Annex A of the CSM ASLP. The scope of reportable events is limited to a subset of Category A events – Significant consequence events. Data sets to be reported per event include occurrence type, location, time and deemed cause of event. Railway operators are responsible for this reporting. It is noted that in the transition period reporting is limited to serious consequence events. O2: Simple reporting of events according to the provisions in Article 4 and Annex A of the CSM ASLP. The scope of reportable events is limited to Category A and B events. Data sets to be reported per event include occurrence type, location, time and deemed cause of event. Railway operators are responsible for this reporting. It is noted that in the transition period reporting is limited to serious consequence events. s O3: Simple reporting of events according to the provisions in Article 4 and Annex A of the CSM ASLP. The scope of reportable events is limited to a subset of Category A events (significant consequence events) as well as selected additional events based on the smart reporting concept. Data sets to be reported per event include occurrence type, location, time and deemed cause of event. Railway operators are responsible for this reporting. It is noted that in the transition period reporting is limited to serious consequence events. O3*: Simple reporting of events according to the provisions in Article 4 of the CSM ASLP. In particular, reporting would comprise all significant consequence events, all accidents with consequence above 5000 euros as well as all Category B events. For the former two the data sets to be

	reported per event include occurrence type, location, time and deemed cause of event. Railway operators are responsible for this reporting. It is noted that in the transition period reporting is limited to serious consequence events. For Category B events the data to be reported per event are limited to occurrence type, location and time. **b) Detailed reporting** O1: Detailed reporting of events according to the provisions in Article 4 and Annex A of the CSM ASLP. The scope of reportable events is limited to a subset of Category A events – Significant consequence events. Data sets to be reported per event include information about the occurrence context and consequences (building on the simple reporting). Railway operators are responsible for this reporting. It is noted that in the transition period reporting is limited to serious consequence events. O2: Detailed reporting of events according to the provisions in Article 4 and Annex A of the CSM ASLP. The scope of reportable events is limited to Category A events. Data sets to be reported per event include information about occurrence context and consequences (building on the simple reporting). Railway operators are responsible for this reporting. It is noted that in the transition period reporting is limited to serious consequence events. O3: Detailed reporting of events according to the provisions in Article 4 and Annex A of the CSM ASLP. The scope of reportable events is limited to a subset of Category A events (significant consequence events) as well as selected additional events based on the smart reporting concept. Data sets to be reported per event include information about occurrence context and consequences (building on the simple reporting). Railway operators are responsible for this reporting. It is noted that in the transition period reporting is limited to serious consequence events. O3*: Detailed reporting for this option is identical to O1 (see above). In particular, the reporting would be limited to significant consequence events. O3* should be seen in conjunction with O3* for SR. These options are aligned with CSM ASLP recommendation. Railway operators are responsible for this reporting. It is noted that in the transition period reporting is limited to serious consequence events. **c) Railway operators' self-assessment** O1: In this option railway operators' (annual) self-assessment would be voluntary. The content and format for the self-assessment is based on the provisions in the CSM ASLP (incl. the Annexes) and any technical supporting documentation the questionnaire to be used by the railway operators.

	O2: Railway operators' (annual) self-assessment would be mandatory. The content and format for the self-assessment is based on the provisions in the CSM ASLP recommendation covering the questionnaire to be used by the railway operators. It is noted that the obligation for operators' self-assessment will start later than the general CSM ASLP application date as part of the proposed transition phase. **d) Reporting on occurrence scenarios and RCMs** O1: The scope of reporting is restricted to significant consequence events (subset of Category A events). Reporting on occurrence scenarios incl. RCMs is specified in the CSM ASLP recommendation. In particular, for the reporting on RCMs only the general part of the template is mandatory while the other parts (2, 3 and 4) are voluntary. It is noted that in the transitionary phase of the implementation of the CSM ASLP reporting is limited to serious consequence events. O2: The scope of reporting is restricted to significant consequence events (subset of Category A events). Reporting on occurrence scenarios incl. RCMs is specified in the CSM ASLP. In particular, for the reporting on RCMs all sections of the corresponding template are mandatory. It is noted that in the transitionary phase of the implementation of the CSM ASLP reporting is limited to serious consequence events. It should be noted that additional reporting on occurrence scenarios beyond the defined scope in these options could be considered (e.g. ROS on request possibly temporarily. However, it is expected that any additional reporting should be properly justified before going ahead. **e) Safety level assessment (SL)** 01: The do-something option for this element is based on the text as provided in the CSM ASLP recommendation. This option will permit the assessment of Safety Level (SL) per operator based on the mandatory reportable events provided by each operator covered by the CSM ASLP. The Agency will be responsible for the calculation of the SL scores at operator, country and Union levels using the ISS tool (when available). The SL scores along with additional trend analyses and statistical tests will be stored in the ISS, shareable according to the rules defined in the CSM ASLP. It is noted that the SL assessment is starting later than the CSM ASLP application date as part of the proposed transition phase. **f) Safety performance assessment (SP)** 01: The do-something option for this element is based on the text as provided in the CSM ASLP. This option will permit the assessment of

	Safety Performance (SP) per operator based on the mandatory self-assessments by railway operators. The Agency will be responsible for the calculation of the SP scores at operator, country and Union levels using the ISS tool (when available). The SP scores along with additional trend analyses and statistical tests will be stored in the ISS, shareable according to the rules defined in the CSM ASLP. It is noted that the SP assessment is starting later than the CSM ASLP application date as part of the proposed transition phase. Obviously, the SP assessment can only take place in a meaningful way if operators' self-assessment are mandatory (see above Option 2 under the element 'Railway operators' self-assessment). **g) Group of Analysts (GoA)** 01: A single do-something option is considered for the Group of Analysts (GoA) corresponding to the provisions in the CSM ASLP recommendation. The main purpose of the GoA is to facilitate collective learning at European level that will interface and feed into the learning taking place at operator and country levels. This Group will have 2 main group of activities: 1) Analysing ISS data for identification of trends and follow-up risk assessments (Joint Network Secretariat approach); 2) Improving the functioning of the CSM ASLP framework incl. Annexes (CCM approach). Participants will include experts representing railway operators, the National Safety Authorities, the Transport of Dangerous Goods Competent Authorities. The European Commission shall be entitled to participate to the GoA meetings as observer. It is foreseen that GoA will start its activities immediately from the date the CSM ASLP regulation shall apply. **h) Information Sharing System (ISS)** 01: An Information Sharing System (ISS) could be set up to be aligned with a relative restricted reporting scope, e.g. the case where reporting is limited to significant consequence events only. This could be reflected through limits in terms of the functionalities available (incl. analytics and data visualization) as well as storing capacity. O2: For this option the ISS would be based on a scalable IT solution to start from a restrictive scope of reporting with upgrade(s) implemented according to increases in reporting. This would allow for a flexible approach in terms of IT solution. Functionalities available in the ISS could be developed gradually while utilizing the original system. Both options would facilitate the reporting by operators and the subsequent sharing of data available in the ISS.
3.3. Uncertainties/risks	Potentially, there could be uncertainties linked to the assessment of impacts of the CSM ASLP given that the recommendation introduces

	the possibility for updating the annexes within the context of the Group of Analysts. Such updates could impact the stakeholders in terms of costs and benefits. However, the draft Recommendation ensures that any amendments / updates of the CSM ASLP annexes would undergo an impact assessment, thereby ensuring that changes should result in net-benefits overall for the sector. As part of these impact assessments there would also be given consideration to whether particular stakeholders would be adversely impacted (e.g. SMEs such as small railway undertakings). For both the railway sector and the authorities importance is given to the work of the CSM ASLP WP emphasizing the issues of reducing double reporting and minimizing / reducing administrative burden.

4. Impacts of the options

4.1. Impacts of the options (qualitative analysis)

A qualitative assessment of the impacts of the options under each of the identified CSM ASLP elements has been undertaken in terms of identifying positive and negative impacts per option per stakeholder. The following stakeholders have been considered:

- *Railway undertakings*
- *Infrastructure managers*
- *Railway manufacturers*
- *Other railway sector stakeholders*
- *National Safety Authorities / TDG Competent Authorities*
- *Agency*

In addition, an overall assessment is performed for each option defined per CSM ASLP element. The overall assessment uses a scoring on a 1-5 scale for positive and negative impacts with 1 = none or very low impact and 5 = very high impact.

a) Simple reporting of events

Railway operators (RUs and IMs) would be the stakeholders most affected by this element of the CSM ASLP as these would be responsible for providing (to the ISS) the information included in the scope for simple reporting. The options reflect differences in terms of the scope for reportable events:

- *All significant consequence events*
- *All Category A and Category B events*
- *All significant consequence events and additional requested events.*
- *All significant consequence events and all Category B events*

Current situation:

At EU level the only systematic reporting on individual events is the notification to the Agency of accident investigations by the NIBs in accordance with the Railway Safety Directive. Also, the annual submission of CSI statistics by NSAs based on railway operator information is of relevance. However, the CSIs are aggregated annual statistics and do not contain information about single events.

Moreover, the Railway Safety Directive includes requirements for operators' Safety Management System to include '*…procedures to ensure that accidents, incidents, near misses and other dangerous occurrences are reported, investigated and analysed and that necessary preventive measures are taken*' (Article 9(3-i). In a number of Member States this is organized within the context of National Occurrence Reporting systems (as mentioned earlier in Section 1). Also of relevance is the annual reporting by RUs and IMs to NSAs under the Railway Safety Directive (Article 9(6)).

	Further details are provided in the CSM SMS (e.g. Annex I, 7.1.1 – Learning from accidents and incidents): *Accidents and incidents related to the organisation's railway operations shall be: (a) reported, logged, investigated and analysed to determine their causes; (b) reported to national bodies as appropriate*'. However, this reporting is not harmonized at EU level (apart from the CSI related stats) making comparative analyses challenging. In addition, there are reporting requirements for railway undertakings and infrastructure managers according to the CSM for Monitoring (Article 5) to the NSA. A common practice is also for railway operators (notably Infrastructure Managers) to provide a daily log of events to the concerned national safety authority. *Positive impacts:* O1: This option limits the simple (disaggregated) reporting to significant consequence events (as defined in the CSM ASLP recommendation). It is assumed that the number of significant consequence events are approximately equal to the number of significant accidents as defined in the Railway Safety Directive. The latest information available shows that there were 1721 significant accidents in 2018 in the EU-28 (compared to 1848 in 2017). Simple reporting on significant consequence events under the CSM ASLP would make readily available consistent and comprehensive data at European level on where the significant consequence events take place, when they take place, event type and deemed cause of accident. Considering the obligations on railway operators (e.g. requirements on learning from accidents and incidents as well as the obligations under the CSM for Monitoring) this comprehensive data set could facilitate the execution of particular tasks leading potentially to reduced resources required or faster identification of solutions to reduce / control risks. For example, prioritization of the monitoring activities could be determined on a more robust basis and / or with fewer resources enabling to take into account information from areas that give rise to the greatest risks (e.g. particular accident hot spots). Similar arguments could be put forward in the case of NSAs with particular focus on their supervision activities. In addition, it is also expected that the Agency / GoA would benefit from the simple reporting in terms of identification of priority areas for improvement in terms EU-level risks. It should be noted that operator advantages would be somewhat limited by the extent to which information on single events in the ISS is shareable or not.

	O2: Compared to O1 simple reporting is extended to all Category A and B events (instead of only reporting significant consequence events). At EU level this would amount to approximately 114 000 events to be reported annually (21925 Category A events and 92000 Category B events). The larger set of reportable events would provide more insights about patterns for other occurrences than significant consequence events incl. other Category A events and Category B events. Positive impacts would be similar in type compared to O1 for railway operators, national authorities and the Agency. In particular, for railway operators there could be advantages through facilitating their obligations under the RSD, CSM SMS and CSM MON. For national safety authorities CSM ASLP simple reporting could support the supervision activities in terms of improved prioritisation and focus on key risk areas. Equally, this reporting could facilitate the Agency in its work to monitor the development of railway safety at Union level and identify areas of improvement. Also, GoA activities would be supported by this reporting. O3: For this option the scope for reportable events covers a subset of Category A events (significant consequence events) as well as selected additional events (from Category A, B and C) through Simple On Request (SOR) reporting. This option would combine the advantages of extensive reporting (O2) with benefits from smart / targeted reporting. Overall, this option would provide similar types of advantages to the stakeholders as O1 and O2 but could offer these in a more efficient and effective way. O3*: Reporting would cover significant consequence events, accidents with consequence above 5000 EUR and all Category B events. The option corresponds to the CSM ASLP recommendation for simple reporting. It would permit a comprehensive monitoring of Category B events thereby providing the basis for SL assessment for all railway operators, incl. small companies. Moreover, it considers both significant consequence events and other accidents with consequence higher than 5000 EUR. *Negative impacts:* O1: The main negative impacts would be experienced by railway operators (RUs and IMs) in terms of resources required for each reportable event (significant consequence events). Other stakeholders may also be impacted although to a more limited extent. Overall, it is expected that the costs for operators in this option would be relative low given the scope for reporting being restricted to significant

consequence events. Further details are provided in Section 4.2 incl. quantification of cost impact.

O2: Overall, it is expected that the costs for operators in this option would be relative high given that the scope for reporting would cover more than 100000 reports per annum. Further details are provided in Section 4.2 incl. quantification of cost impact.

O3: This option would generate higher costs for operators than O1, but lower costs than O2. Moreover, it is foreseen that Simple On Request (SOR) reporting from GoA would only be issued provided this would be economically viable.

O3*: The main negative impacts would be experienced by railway operators (RUs and IMs) in terms of resources required for each reportable event (significant consequence events). Other stakeholders may also be impacted although to a more limited extent. It is foreseen that the reporting of Category B events (as provided for in the CSM ASLP recommendation) would not involve substantial time (a lower time duration is assumed for O3*).

- Note that impacts in the transitionary phase will be very limited given that the reporting would only concern serious consequence events

Overall assesment	*Impact*	*O0*	*O1*	*O2*	*O3*	*O3**
	Positive	1	3	3	4	4
	Negative	1	2	4	3	3

b) Detailed reporting

Railway operators (RUs and IMs) would be the stakeholders most affected by this element of the CSM ASLP as these would be responsible for providing (to the ISS) the information included in the scope for detailed reporting. The options reflect differences in terms of the scope for reportable events:

- *All significant consequence events only*
- *All Category A events*
- *All significant consequence events and additional requested events.*
- *All significant consequence events only (in conjunction with more extensive simple reporting for Category B events, see above)*

Current situation:

	At EU level the only systematic reporting on individual events is the notification to the Agency of accident investigations by the NIBs in accordance with the Railway Safety Directive. Also, the annual submission of CSI statistics by NSAs based on railway operator information is of relevance. However, the CSIs are aggregated annual statistics and do not contain information about single events. Moreover, the Railway Safety Directive includes requirements for operators' Safety Management System to include '*…procedures to ensure that accidents, incidents, near misses and other dangerous occurrences are reported, investigated and analysed and that necessary preventive measures are taken*' (Article 9(3-i). In a number of Member States this is organized within the context of National Occurrence Reporting systems (as mentioned earlier in Section 1). Also of relevance is the annual reporting by RUs and IMs to NSAs under the Railway Safety Directive (Article 9(6)). Further details are provided in the CSM SMS (e.g. Annex I, 7.1.1 – Learning from accidents and incidents): *Accidents and incidents related to the organisation's railway operations shall be: (a) reported, logged, investigated and analysed to determine their causes; (b) reported to national bodies as appropriate*'. However, this reporting is not harmonized at EU level (apart from the CSI related stats) making comparative analyses challenging. In addition, there are reporting requirements for railway undertakings and infrastructure managers according to the CSM for Monitoring (Article 5) to the NSA. A common practice is also for railway operators (notably Infrastructure Managers) to provide a daily log of events to the concerned national safety authority. *Positive impacts:* O1: This option limits the detailed (disaggregated) reporting to significant consequence events (as defined in the CSM ASLP recommendation). It is assumed that the number of significant consequence events are approximately equal to the number of significant accidents as defined in the Railway Safety Directive. The latest information available shows that there were 1721 significant accidents in 2018 in the EU-28 (compared to 1848 in 2017). Detailed reporting on significant consequence events under the CSM ASLP would make readily available consistent and comprehensive data at European level on the context of the occurrence along with information on consequences as well as simple reporting (place, time, occurrence type and deemed cause). Considering the obligations on railway operators (e.g. requirements on learning from accidents and incidents as well as the obligations under the CSM for Monitoring) this comprehensive data set could facilitate

	the execution of particular tasks leading potentially to reduced resources required or faster identification of solutions to reduce / control risks. For example, prioritization of the monitoring activities could be determined on a more robust basis and / or with fewer resources enabling to take into account information from areas that give rise to the greatest risks (e.g. particular accident hot spots). Similar arguments could be put forward in the case of NSAs with particular focus on their supervision activities. In addition, it is also expected that the Agency / GoA would benefit from the detailed reporting in terms of identification of priority areas for improvement in terms EU-level risks. It should be noted that operator advantages would be somewhat limited by the extent to which information on single events in the ISS is shareable or not. O2: Compared to O1 the detailed reporting is extended to all Category A events (instead of only reporting significant consequence events). At EU level this would amount to approximately 22000 events to be reported annually. The larger set of reportable events would provide more insights about patterns for other occurrences than significant consequence events incl. other Category A events. Positive impacts would be similar in type compared to O1 for railway operators, national authorities and the Agency / GoA. In particular, for railway operators there could be advantages through facilitating their obligations under the RSD, CSM SMS and CSM MON. For national safety authorities CSM ASLP detailed reporting could support the supervision activities in terms of improved prioritisation and focus on key risk areas. Equally, this reporting could facilitate the Agency in its work to monitor the development of railway safety at Union level and identify areas of improvement. O3: For this option the scope for reportable events covers a subset of Category A events (significant consequence events) as well as selected additional events (from Category A, B and C) through Detailed On Request (DOR) reporting. This option would combine the advantages of extensive reporting (O2) with benefits from smart / targeted reporting. Overall, this option would provide similar types of advantages to the stakeholders as O1 and O2 but could offer these in a more efficient and effective way. O3*: This option is identical to O1. It is noted that the option corresponds to the provisions in the CSM ASLP recommendation. For details of positive impacts see under O1. *Negative impacts:*

O1: The main negative impacts would be experienced by railway operators (RUs and IMs) in terms of resources required for each reportable event (significant consequence events). Other stakeholders may also be impacted although to a limited extent. Overall, it is expected that the costs for operators in this option would be relative low given the scope for reporting being restricted to significant consequence events. Further details are provided in Section 4.2 incl. quantification of cost impact.

O2: Overall, it is expected that the costs for operators in this option would be relative high given the scope for reporting cover more than 22000 reports per annum. Further details are provided in Section 4.2 incl. quantification of cost impact.

O3: This option would generate higher costs for operators than O1, but lower costs than O2. Moreover, it is foreseen that Detailed On Request (DOR) reporting from GoA would only be issued provided this would be economically viable.

O3*: This option is identical to O1. It is noted that the option corresponds to the provisions in the CSM ASLP recommendation. For details on negative impacts see under O1.

- Note that impacts in the transitionary phase will be very limited given that reporting would only concern serious consequence events

Overall assessment	*Impact*	*O0*	*O1*	*O2*	*O3*	*03**
	Positive	1	3	3	4	3
	Negative	1	2	4	3	2

c) Railway operators' self-assessment

This CSM ASLP element would require railway operators to complete annually a self-assessment of their maturity for the management of risk control measures covering planning of risk control measures; setting up and operating of risk control measures; monitoring of risk control measures; reviewing and adjusting risk control measures (in accordance with the PDCA approach). Therefore, railway operators would be the most directly impacted stakeholder category. Two do-something options are considered:

- *Self-assessments are voluntary*

	• *Self-assessments are mandatory* *Current situation:* At EU-level this CSM ASLP element does not exist today. If this type of self-assessments exist currently, it is not done on a consistent basis between EU member states. However, there are requirements in both the CSM SMS and the CSM MON which concerns similar aspects as the self-assessment in the CSM ASLP. In particular, the CSM SMS (e.g. Annex I, part 6.1.1 - Monitoring) establishes that '…*The organisation shall perform monitoring in accordance with Regulation (EU) No 1078/2012: (a) to check the correct application and the effectiveness of all the processes and procedures in the safety management system, including the operational, organisational and technical safety measures'*. The latter point concerns risk control measure. This provision is a self-assessment that includes the extent to which risk control measures are efficiently and effectively managed. The main difference of today's situation compared to the CSM ASLP is that the assessment results are not set out in a harmonized way and are not shared with external parties. *Positive impacts:* O1: Voluntary self-assessment of SP maturity re. the management of RCMs could generate some of the positive impacts for the different stakeholders described under option 2 (Mandatory reporting). However, it is likely that these would be significantly lower especially for NSAs / Agency / GoA where limited reporting would not deliver a comprehensive picture of SP maturity at country nor European level. O2: The maximum potential positive impacts from this self-assessment would be captured with this option. In particular, national safety authorities would receive a systematic and harmonized overview of the maturity for individual operators re. their management of risk control measures as well as trends at country and union levels. This should enable improved prioritization and planning of their supervision tasks as well as optimizing learning from outcomes of supervision. Railway operators are also likely to obtain benefits as the self-assessment gives a structured overview of how the different elements of their management of risk control measures are performing. This may contribute to identify areas that would require improvements. For the Agency / Commission / GoA this element of the CSM ASLP would support the identification of improvement areas of safety for SERA. In

particular, the SP maturity assessment would contribute to the planned activities of GoA, notably 'Identify and evaluate risks' and 'mitigate risks'.

Negative impacts:

O1: Given that this CSM ASLP element is voluntary for operators there would only be limited costs (that should be outweighed by the perceived operator benefits). On the other hand the voluntary approach may limit the extent to which operators would choose to perform formally the self-assessment and then report it, thereby reducing the positive impacts for all stakeholders in terms of additional information inputs for their safety-related activities (notably monitoring for railway operators and supervision for national safety authorities).

O2: Negative impacts would mainly concern the costs for railway operators for completing the annual SP self-assessment. These costs would primarily be staff costs. It is likely that the required costs could be rather limited given that there are already requirements in the CSM SMS and the CSM MON for this type of assessment. What is new is that a common template has to be used and it has to be reported into the ISS.

- Note that in the transitionary phase no impacts are foreseen for this element given that it is not starting during that period

Overall assessment	*Impact*	*O0*	*O1*	*O2*
	Positive	1	2	3
	Negative	1	1	2

d) Reporting on occurrence scenarios and RCMs

Railway operators would be directly impacted by this CSM ASLP element covering reporting on two interrelated aspects: occurrence scenarios and risk control measures. Two do-something options have been identified:

- *Reporting restricted to significant consequence events with RCM information voluntary (except Part 1 of Annex III, B)*
- *Reporting restricted to significant consequence events with all RCM information mandatory*

	For both options the scope for this reporting is limited to occurrence scenarios and RCMs for significant consequence events. In the case of O1 only the general part of the RCM template is mandatory to complete, while in the case of O2 all parts of the RCM template are mandatory to complete. It should be noted that O1 corresponds to the current draft of the CSM ASLP. *Current situation:* At EU level this reporting does not exist with the exception of any analyses available undertaken within the JNS. At national level there are already existing requirements for railway operators in this field notably in the CSM SMS and CSM Monitoring. In the case of the CSM SMS (e.g. Annex I, point 7.1.1 – under Learning from accidents and incidents) the following applies: *'Accidents and incidents related to the organisation's railway operations shall be:(a) reported, logged, investigated and analysed to determine their causes; (b) reported to national bodies as appropriate'*. Moreover, the CSM MON sets out clearly requirements for RUs, IMs and ECMs (see Article 1 (2a)): *'… to check the correct application and the effectiveness of all the processes and procedures in the management system, including the technical, operational and organisational risk control measures'*. Also, the CSM MON includes provisions for exchange of information between the involved actors (Article 4) and for Reporting (Article 5). The main difference between the current situation and the CSM ASLP elements is that the operators are not using common templates for recording this type of information and that specific information on RCMs / occurrence scenarios are in general not shared. *Positive impacts:* O1: It is expected that railway operators, national authorities and Agency / Commission / GoA will be able to obtain advantages from this reporting. Railway operators would have access to structured / harmonized information on occurrence scenarios and relevant risk control measures in the context of significant consequence events (access to specific information would though depend on the rules for sharing in the ISS). This would contribute to strengthening the fulfilment of the requirements in the CSM SMS on learning from accidents and incidents. Moreover, it could also facilitate their application of the CSM MON (notably regarding monitoring the effectiveness of risk control measures). Furthermore, reporting on occurrence scenarios may also provide an input to operators' risk assessments undertaken in accordance with the CSM RA. For NSAs there could be benefits linked to their supervision activities in terms of better prioritization and planning facilitating the identification and

mitigation of risk areas. At Agency / Commission / GoA level this reporting would support several activities geared towards the identification of feasible safety improvement areas within SERA, notably through the systematic improvement of the management of the RCM PDCA cycle. In particular, this concerns the following GoA activities:

- *Identify and evaluate risks*
- *Mitigate risks*
- *Manage RCMs*

Other stakeholders than the ones listed above may also draw advantages from this reporting, e.g. ECMs and railway manufacturers.

O2: It is expected that there would be similar advantages for this option compared to the ones outlined in detail under O1 (see details above). However, this option would provide mandatorily more in-depth information concerning the RCMs (Parts 2, 3 and 4), whereas O1 would only require Part 1 to be completed.

Negative impacts:
O1: Main impacts would concern the staff costs on operator side to provide the reporting on occurrence scenarios and RCMs for significant consequence events in accordance with pre-defined templates. It is expected that the costs would be lower than for O2 given that parts 2, 3 and 4 of the information on RCMs is not mandated to be reported. On the other hand this may limit the value of the reported RCM information. Quantitative information on expected costs will be provided in section 4.2

O2: Similar type of costs are expected for this option compared to O1, albeit at a higher level since all elements of the RCM template are required to be reported for significant consequence events. Quantitative information on costs will be provided in section 4.2

- Note that impacts in the transitionary phase will be very limited given that reporting would only concern serious consequence events

Overall assessment	*Impact*	*O0*	*O1*	*O2*
	Positive	1	3	4
	Negative	1	2	3

e) Safety level assessment (SL)

The Agency will be the main stakeholder directly affected as it is responsible for the actual calculation of the SL indicators based on the simple reporting from railway operators. This assessment will be set up as part of the ISS in order to minimize required resources for the calculations. Outcomes of the SL assessment in terms of scores and trends at operator, national and Union levels will be stored in the ISS. In accordance with the sharing rules set out for available records stakeholders (notably railway operators and national authorities) will have access to all scores and trends at national and union levels. In addition, national authorities will also have access to the SL information concerning individual companies operating in their country, while individual railway operators will have access to information about their own SL levels. Moreover, shareable SL information will provide an input to the work of the Group of Analysts.

Current situation:

At EU level the current situation regarding SL type assessment is limited to the annual assessment of achieving the CSTs of the EU Member States but no assessment is performed of individual operators. Furthermore, available EU legislation includes requirements in this field, notably that operators' annual report to the NSA should include information about quantitative and qualitative targets (see Railway Safety Directive, Article 9) and requirements in the CSM SMS on safety objectives (e.g. Annex I, section 3.2) to be set and monitored (under the CSM for monitoring – Annex, para. 2.4). However, these requirements are not harmonised between operators. At national level there are some benchmarking analyses being undertaken by some national authorities to compare operators in terms of risk profiles but not done consistently across the EU.

Positive impacts:

The SL related information would be pertinent to a number of stakeholders, incl.:

- *Railway undertakings*
- *Infrastructure managers*
- *National authorities*
- *Agency / Commission*
- *Group of Analysts (GoA)*

In particular, for national authorities (notably NSAs) this could provide structured and harmonized indications re. the risk profile of operators in their country. This could be a useful input for their supervision

activities incl. overall supervision strategy and plans as well as reviewing the outcomes of the supervision activities. For the Agency / Commission / GoA this type of information is of importance as inputs for determining focus areas for improvement of the management of safety in SERA. Operators may also obtain positive impacts from the SL information (albeit more limited than for national authorities / ERA / Commission). In particular, operators would be informed about how their SL compares to the national and EU level. Such information could trigger analyses within single operators on the reasons behind their relative performance and may generate follow-up actions in order to improve their operations. Indeed, the SL information could be an additional input for their monitoring activities undertaken within the scope of the CSM for Monitoring.

Negative impacts:
No negative impacts are foreseen from the SL element of the CSM ASLP recommendation with the exception of the Agency for which limited additional resources would be required to manage the calculation of SL indicators.

- Note that in the transitionary phase no impacts are foreseen for this element given that it is not starting during that period

Overall assessment	*Impact*	*O0*	*O1*
	Positive	1	3
	Negative	1	1

f) Safety performance assessment (SP)

The Agency will be the main stakeholder directly affected as it is responsible for the actual calculation of SP indicators based on the railway operators' self-assessment of their safety performance. This assessment will be set up as part of the ISS in order to minimize required resources for the calculation. Outcomes of the SP assessment in terms of scores and trends at operator, national and Union levels will be stored in the ISS. In accordance with the sharing rules set out for available records, stakeholders (notably railway operators and national authorities) will have access to all scores and trends at national and union levels. In addition, national authorities will also have access to the SP information concerning companies operating in their country, while individual railway operators will have access to information about

	their own SP levels. Moreover, shareable SP information will be provided as an input to the work of the Group of Analysts. *Current situation:* At EU level SP assessments have not been done to date for single railway operators nor aggregated to national and Union levels. There are some similarities with Agency work undertaken through the Priority Programme and the NSA Monitoring Matrix (although this focused on assessing maturity at the level of authorities). At national level SP type assessments are being done by some Member States, e.g. comparative maturity assessments, in the context of their supervision responsibilities. However, the work is not harmonized between MSs nor is it carried by all countries. *Positive impacts:* The SP related information would be pertinent to a number of stakeholders, incl.: • *Railway undertakings* • *Infrastructure managers* • *National authorities* • *Agency / Commission* • *Group of Analysts (GoA)* In particular, for national authorities (notably NSAs) this could provide structured and harmonized indications re. the relative maturity of operators in their country. In particular, this could be a useful input for their supervision activities incl. overall supervision strategy and plans (in terms of operators to be prioritized) as well as reviewing the outcomes of the supervision activities. For the Agency / Commission / GoA this type of information is of importance as inputs for determining focus areas for improvement of the management of safety in SERA. Operators may also obtain positive impacts from the SP information (albeit more limited than for national authorities / ERA / MOVE). In particular, operators would be informed about how their SP compares to the national and EU level. Such information could trigger analyses within single operators on the reasons behind their relative level of maturity and may generate follow-up actions in order to improve their SMS frameworks. Indeed, the SP information could also be an additional input to their monitoring activities undertaken within the scope of the CSM for Monitoring. *Negative impacts:* Limited negative impacts are foreseen from the SP element of the CSM ASLP recommendation with the exception of the Agency for which

limited additional resources would be required to manage the calculation of SP indicators. Moreover, the SP assessment could trigger extended discussions between NSAs, operators and the Agency re. the outcome(s). This issue would need to be carefully managed.

- Note that in the transitionary phase no impacts are foreseen for this element given that it is not starting during that period

Overall assessment	*Impact*	*O0*	*O1*
	Positive	1	3
	Negative	1	1

g) Group of Analysts (GoA)

GoA would be a European level platform set up to facilitate collective learning at Union level feeding into the learning taking place at operator, national and regional levels. In particular, it is foreseen that GoA will undertake analyses of data and Information made available through the CSM ASLP. These analyses may in turn lead to the identification of safety-related improvement needs and definition of practicable solutions for the Union railway safety improvements. Moreover, GoA would be responsible for reviewing and developing the CSM ASLP framework with particular focus on the annexes (incl. the Technical Supporting Documents).

Current situation:

At European level the Joint Network Secretariat (JNS) is set up to ensure EU-wide harmonisations of any action taken after any issue, e.g. accidents or incidents in railways in the EU. As such it has a more limited scope than the plans included in the CSM ALSP recommendation. However, it does offer a useful point of reference for setting up the GoA. Similar fora exist at national / regional levels, e.g. cooperation between national authorities in cross-border regions.

Positive impacts:

Overall, the positive impacts would come from the contribution that GoA can make in terms of an improved basis for collective learning at all levels. This contribution could come from several GoA activities, incl.:

- *Data and information analyses using of records available in the ISS, incl. trends and statistical inferences as well as specific safety occurrences*

- *Provision of information to the Union railway stakeholders concerning informal guidance or alerts as necessary,*
- *Identification of safety-related improvement needs, and*
- *Definition of practicable solutions for the Union railway safety improvements*

These activities could feed into learning among individual railway operators through better targeted monitoring and for enhanced supervision undertaken by national authorities. A key issue to consider for the setting up of the CSM ASLP is how to ensure an optimal framework for the interface between GoA based learning and the learning at operator / national levels.

Negative impacts:
The main negative impacts would concern the resources required for setting up the GoA along with ongoing resources for running and participating to the work of this group. It may be possible to reduce costs somewhat through extensive use of remote meetings.

Overall assessment	*Impact*	*O0*	*O1*
	Positive	1	4
	Negative	1	2

h) Information Sharing System (ISS)

The key role for the ISS in the CSM ASLP recommendation is to facilitate in the first instance the reporting by railway operators (simple and detailed reporting of events / occurrence scenarios and risk control measures / safety performance self-assessments). In addition, the ISS is required to support the sharing of information available. A key issue to consider is the type of IT system required to ensure these aspects. As such these aspects can be established in different ways with varying levels of service provided and resources involved. This provides the rationale for considering 2 options (as outlined in Section 3).

Current situation:
Several systems exist at EU level, notably ERAIL, SIS and SAIT. At country level there are several operator specific systems as well as national systems (e.g. NORs). However, none of the available systems concern direct reporting by single railway operators to a European level.

Positive impacts:

O1: The IT system would support operators reporting requirements while also facilitating all stakeholders' access and use of the information reported to the Union level. A key issue for the definition of the IT specifications would be ensuring user interfaces that are easy to understand and operate.

O2: The IT system would support operators' reporting requirements while also facilitating all stakeholders' access and use of the information reported to the Union level. A key issue for the definition of the IT specifications would be ensuring user interfaces that are easy to understand and operate.

Negative impacts:

O1: The main negative impact concerns the costs for setting up the IT system as well as ongoing costs for operating and maintaining the system. These costs are incurred by the Agency. In addition, there would be costs incurred by railway operators / national authorities who decides to use any pre-existing systems to interface with the ISS. These costs cover one-off items for the interface(s) as well as ongoing costs for updating, operating and maintaining these. An IT option with less scope for scalability may be lower in terms of short term costs but could over the long term offer less flexibility, especially in a context with varying levels of reporting.

O2: The main negative impact concerns the costs for setting up the IT system as well as ongoing costs for operating and maintaining the system. These costs are incurred by the Agency. In addition, there would be costs incurred by railway operators / national authorities who decides to use any pre-existing systems to interface with the ISS. These costs cover one-off items for the interface(s) as well as ongoing costs for updating, operating and maintaining these. It is likely that a scalable IT option may optimise resources by permitting flexibility in terms covering for different levels of reporting.

Overall assessment	*Impact*	*O0*	*O1*	*02*
	Positive	1	3	4
	Negative	1	2	3

4.2. Impacts of the options (quantitative analysis)	The quantitative analysis (the specific assumptions on parameter values are included in **Annex EcoEv 1**) includes in particular:
	• Cost impact for the Agency:
	  ○ one-off costs for the Information Sharing System (ISS) as well as the setting up of GoA
	  ○ recurring costs per annum for developing and maintaining the ISS as well as coordinating and facilitating GoA + SP / SL assessments. In addition, there would be resources linked to legal matters as well as data quality control (although operators are responsible for the quality of the data and information reported)
	• Cost impact for the National Safety Authorities:
	  ○ one-off costs for setting up the IT interfaces between any national systems and the ISS
	  ○ recurring costs from maintaining and upgrading interfaces + participation to the GoA activities
	• Cost impact for railway operators
	  ○ one-off costs for setting up the IT interfaces to national systems (moreover, depending on the exact details of the CSM ASLP provisions there could also be one-off costs for adapting existing systems and processes)
	  ○ recurring costs for simple reporting of events
	  ○ recurring costs for detailed reporting of events
	  ○ recurring costs for reporting RCM and occurrence scenarios
	  ○ recurring costs for preparing self-assessment of safety performance
	  ○ recurring costs for the participation in GoA
	  ○ recurring costs linked to regular participation in training to retain competencies linked to the CSM ASLP reporting obligations
	• Potential cost savings for railway operators (efficiency gains due to savings in resources linked to monitoring and auditing the SMS) as well as savings from effectiveness gains due to reduced accident / incident related costs arising due to improved learning from incidents (notably near-misses and similar events).
	• Further details concerning the evidence base for the considered benefits and costs are contained in **Annex EcoEv 1**.
	
	It should be noted that in the following analysis are only those benefits for which quantification was possible. However, as highlighted in Section 4.1 other organisations (e.g. NSAs and Agency) may also benefit.

Notes:

- *For all categories the estimated quantitative impacts measure the change in **mill. Euros** relative to the baseline (Option 0 or Do-Nothing). For the cost impacts positive values imply increased costs, while negative values imply decreased costs (compared to the baseline). For the values for benefits a positive figure would imply increased gains in efficiency and effectiveness.*
- *In the case of one-off impacts the values are assumed to be incurred in a single year only (Year 0 in the CBA calculation).*
- *For recurring impacts the values shown are incurred each year over the assumed lifetime (20 years).*
- *The values given for impacts for stakeholders are expressed as aggregated figures. Therefore, in order to determine the impact per entity these values would need to be divided by the number of entities (e.g. number of railway operators / National Safety Authorities).*
- *These are estimates based on the input collected from available evidence (incl. the analyses from the COR project), grounded on assumptions and can therefore not be considered as being accurate measurements.*
- *The quantitative modelling can accommodate additional elements for the options, e.g. differential approach re. simple and detailed reporting for the events within the scope as well as testing for the implication of degree of complexity of the reporting (linked to templates)*

a) Simple reporting of events

Potential benefits and costs linked to the simple reporting of events are detailed below.

Benefits:

O1:

Main benefits are linked to more reliable and effective data available at European level about significant consequence events regarding type of accidents, location, time and deemed cause(s). This is expected to assist the different stakeholders, notably railway operators, national authorities and European level actors in their activities geared towards safety management and controlling risks. In particular, it should be easier for railway operators to focus their monitoring activities on key risk areas increasing the probability that appropriate measures / actions could be identified. This may have positive implications both on resources involved and the overall risk profile. Equally, there could be benefits for national authorities in terms of better targeted supervision activities. Moreover, the simple reporting would provide a critical input

	to the activities of the Agency and GoA. This reporting is expected to capture a significant part of the efficiency and effectiveness gains outlined later in this section. Overall, benefits are expected to outweigh costs. O2: Compared to O1 a larger data set would be available covering all Category A as well as Category B events. This option provides also data on near misses which could be of added value to the stakeholders. Other benefit types listed under O1 are also relevant for this option. It is expected that O2 would capture a significant part of the overall benefits expected from the CSM ASLP. However, given the amount of reporting (over 100000 events expected per annum) it is possible that costs would be higher than the apportioned benefits. O3: This option would have similar benefits as for O1 but in addition this option also generates benefits from the smart reporting of selected Category A, B and C events (SOR). As such this would provide insight into a broader spectrum of accidents and incidents for which the SMS would need to be able to control. Other benefit types listed under O1 / O2 are also relevant for this option. It is expected that O3 would capture a significant part of the overall benefits foreseen from the CSM ASLP. Moreover, it is expected that this option would generate benefits that are higher than the costs of the reporting. O3*: This option provides a comprehensive data set on significant consequence events, all accidents with consequence higher than 5000 EUR and all Category B events. This is expected to assist the different stakeholders, notably railway operators, national authorities and European level actors in their activities geared towards safety management and controlling risks. In particular, it should be easier for railway operators to focus their monitoring activities on key risk areas increasing the probability that appropriate measures / actions could be identified. This may have positive implications both on resources involved and the overall risk profile. It is expected that O3* would capture a significant part of the overall benefits foreseen from the CSM ASLP. Moreover, it is expected that this option would generate benefits that are higher than the costs of the reporting. This point should also be seen in conjunction with limited reporting scope for DR, occurrence

	scenarios and RCMs (only significant consequence events) as specified in the CSM ASLP recommendation. *Costs:* The costs concern principally railway operators. As such this item is a key in terms of administrative burden (as well as this obligation providing the main inputs for collective learning). Key determinants are: a) Time required per report; b) hourly labour costs; c) expected number of reportable events. In the cost calculations for the 3 options a) and b) are kept constant while the number of reportable events will vary. In accordance with the requirements in the CSM SMS it is assumed that systems are in place where information required for the simple reporting is available. Moreover, an important distinction should be made between the templates in the annex for simple reporting in the CSM ASLP recommendation and the corresponding one(s) in the ISS to be used by operators reporting. In particular, it is foreseen that most fields would be pre-filled with default values. For any given report it is expected that less than 10 fields would be required to be completed. O1 (SR for significant consequence events): Total costs for railway operators under this option would be equal to: **40117 EUR** = 1721 x 0.555 (hours per report)[13] x 42[14] EUR / hour O2 (SR for Category A and B events): Total costs for railway operators under this option would be equal to: **2.656 mln EUR** = 113925 (Category A and B events) x 0.555 (hours per report) x 42 EUR / hour O3 (SR for significant consequence events and SOR for selected additional events): Total costs for railway operators under this option would be equal to: **0.583 mln EUR** = 25000 (1721 significant consequence events + 23279 other events) x 0.555 (hours per report) x 42 EUR / hour

[13] The 0.555 hour per report is based on the UK's impact assessment of the RIDDOR system (Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (as amended)) from 2013. In particular, for time for filling out the reporting template was after consultation with HSE experts confirmed to be approx. 33 minutes. See further information in this link:
https://www.legislation.gov.uk/ukia/2013/33/pdfs/ukia_20130033_en.pdf

[14] The assumed hourly labour cost figure of 42 EUR/h has been derived considering available national labour cost statistics for job profiles expected to correspond to the ones for CSM ASLP tasks (in the upper end of medior / lower end of senior). Particular attention in setting the assumption was given to renumeration in the Netherlands and Denmark.

	The figure of 25000 would allow SOR of some 23279 events in addition to the significant consequence events. O3* (SR for significant consequence events, all accident with consequence of more than 5000 EUR and all Category B events: Total costs for railway operators under this option would be equal to: **0.877 mln EUR** = 10000 (1721 significant consequence events + about 8279 accidents with consequence above 5000 EUR) x 0.555 (hours per report) x 42 EUR / hour + 92000 x 0.1666 x 42 EUR / hour It is assumed that the implemented Category B event SR reporting would be less time consuming than the SR reporting for other events in accordance with the provisions in the CSM ASLP recommendation. This aspect would need to be considered as part of monitoring of the application of the CSM ASLP. **b) Detailed reporting** Potential benefits and costs linked to the detailed reporting of events are detailed below. *Benefits:* O1: This option would ensure a comprehensive and harmonized dataset for all significant consequence events. Apart from data on location, time, event type and deemed cause (from the simple reporting) there would also be consistent records on the context as well as the consequences for each accident reported. This would contribute to key tasks for railway operators, national authorities and European level actors in their activities geared towards safety management and controlling risks. In particular, it should be easier for railway operators to focus their monitoring activities on key risk areas increasing the probability that appropriate measures / actions could be identified. This may have positive implications both on resources involved and the overall risk profile. Equally, there could be benefits for national authorities in terms of better targeted supervision activities. Moreover, the simple reporting would provide a critical input to the activities of the Agency and GoA. This reporting is expected to capture a significant part of the efficiency and effectiveness gains outlined later in this section. Overall, benefits are expected to outweigh costs.

	O2: Compared to O1 a larger data set would be available covering all Category A and not only significant consequence events. Benefit types listed under O1 are also relevant for this option. It is expected that O2 would capture a significant part of the overall benefits expected from the CSM ASLP. However, the amount of reporting (over 20000 events expected per annum) brings costs and a more efficient approach may be O3 where the concept of smart reporting is applied. O3: This option would have similar benefits as for O1 but in addition this option also generate benefits from the smart reporting of selected Category A, B and C events (DOR). As such this would provide insight into a broader spectrum of accidents and incidents for which the SMS would need to be able to control. Other benefit types listed under O1 / O2 are also relevant for this option. It is expected that O3 would capture a significant part of the overall benefits expected from the CSM ASLP. Moreover, it expected that this option would generate benefits that are higher than the costs of the reporting. O3*: This option corresponds to O1. Details of benefits are outlined under that option. *Costs:* The costs concern principally railway operators. As such this item is a key in terms of administrative burden (as well as this obligation providing the main inputs for collective learning). Key determinants are: a) Time required per report; b) hourly labour costs; c) expected number of reportable events. In the cost calculations for the 3 options a) and b) are kept constant while the number of reportable events will vary. In accordance with the requirements in the CSM SMS it is assumed that systems are in place where information required for the detailed reporting is available. Moreover, an important distinction should be made between the templates in the annex for detailed reporting in the CSM ASLP recommendation and the corresponding one(s) in the ISS to be used by operators reporting. In particular, it is foreseen that most fields would be pre-filled with default values. For any given report under DR 30+ data fields should be completed along with optionally free text fields. O1 (DR for significant consequence events): Total costs for railway operators under this option would be equal to:

	0.108 EUR = 1721 (significant consequence events) x 1.5 (hours per report) x 42 EUR / hour O2 (DR for Category A events): Total costs for railway operators under this option would be equal to: **1.381 mln EUR** = 21925 (Category A events) x 1.5 (hours per report) x 42 EUR / hour O3 (DR for significant consequence events and DOR for selected additional events): Total costs for railway operators under this option would be equal to: **0.630 mln EUR** = 10000 (1721 significant consequence events + 8279 other events) x 1.5 (hours per report) x 42 EUR / hour The figure of 10000 would allow DOR of some 8279 events per annum in addition to the significant consequence events. O3*: The option corresponds to O1. Details of costs are available in the analysis given for that that option. It should be noted that the estimated resources for DR reporting would be sufficient to accommodate for DOR reporting notably concerning level crossing accidents and accidents to persons involving rolling stock in motion. **c) Railway operators' self-assessment** Potential benefits and costs associated with the railway operators' self-assessment are outlined below. *Benefits:* O1: Given the voluntary reporting for operators for O1 it is expected that benefits for operators alone would outweigh the costs of reporting. It could provide an input for their SMS, especially linked to the monitoring requirements. Furthermore, it could provide improved insight from a structured perspective of the elements of their management of the risk control measures that would need to be strengthened. Moreover, there could be benefits for NSAs as an input to their supervision as well as for GoA and the Agency, although these are perceived to be of less importance given that the reporting is only voluntary. O2: In a mandatory setting it is likely that the data delivered are more effective for railway operators. Moreover, this input would be useful for

	NSAs providing a more reliable insight into what areas of the operators' management of risk control measures would need to be given priority as part of their supervision. Equal arguments could be forward for the usability of the SP maturity information for GoA as well as for the Agency. It is expected that this part of the CSM ASLP reporting is less critical than the reporting of events, occurrence scenarios and risk control measures. However, it is still expected that benefits of SP self-assessment reporting would outweigh the costs of this reporting. *Costs:* O1: Costs would mainly be incurred by railway operators in terms of staff resources. As O1 makes the self-assessment voluntary it is expected that these costs would be lower than the ones incurred for O2. The exact amount would depend on the extent of voluntary reporting. O2: Main costs would be for railway operators covering staff related costs for performing the self-assessment according to the CSM ASLP templates. It is foreseen that the ISS (when available) will permit online completion of the self-assessment. Moreover, given that the CSM ASLP self-assessment draws on information that should be available in accordance with the requirements in the CSM SMS and the CSM MON staff resources are not foreseen for the collection of new information. In particular, annual average costs per railway operator for this obligation is foreseen to be equal to: **672 EUR** = 16hours x 42 EUR Where 16 hours is the expected staff time per self-assessment and 42 EUR is the hourly labour cost. On this basis, the total annual costs for all railway operators would be equal to: **0.806 mln EUR** = 672 EUR x 1200 Where 1200 is the assumed number of railway operators for which the CSM ASLP would apply to. **d) Reporting on occurrence scenarios and RCMs** Benefits and costs for the reporting on occurrence scenarios and RCMs are considered below.

	Benefits: O1: This option limits the mandatory RCM reporting to only the general part (Part 1) for significant consequence events. Despite this limitation it is still expected that stakeholders could obtain benefits through improved understanding of which risk control measures are working as intended along with enhanced information on the occurrence scenarios established for all significant consequence events. In fact, this option may provide the starting point for analyses (within GoA) to determine whether this reporting scope and depth is optimal depending on return of experience. Other benefits are further detailed out under O2. It is expected that the benefits of this option would be higher than the estimated costs. It is not possible to reliably estimate the proportion of the overall benefits from the CSM ASLP package that can be apportioned to this element of reporting. However, it is expected that this could be one of the main sources of benefits. O2: The systematic and harmonized reporting of occurrence scenarios and RCMs linked to significant consequence events is expected to provide an effective and reliable information dataset optimizing procedures and identifying actions for continuous improvement in the field of safety management. This up-to-date dataset would be of relevance for several stakeholders notably railway operators, national authorities and GoA / Agency. In particular, it is expected that this reporting would assist railway operators in two main ways: 1) improved scope for identifying actions regarding risk control measures in place; 2) improved scope for learning from accidents in terms of understanding the underlying scenarios. This may provide the basis for using resources in a more targeted / efficient way and also leading to improved safety outcomes. In parallel national authorities could use this information to focus better their supervision strategy / plan on key areas of concern. Moreover, the information will also be an important input for GoA as well as for the Agency in order to understand the overall safety risks and consider effective measures to control these better at European level. Overall, it is expected that the possible efficiency and effectiveness gains from this option would outweigh the costs associated with this reporting under this option. It is not possible to reliably estimate the proportion of the overall benefits from the CSM ASLP package that can be apportioned to this element of reporting. However, it is expected that this could be one of the main sources of benefits.

	Costs: The costs concern principally railway operators. As such this item is a key in terms of administrative burden (as well as this obligation providing the main inputs for collective learning). Key determinants are: a) Time required for completion of the report required under Annex III of the CSM ASLP; b) hourly labour costs; c) expected number of events for which information about occurrence scenarios and RCMs are required. In the cost calculations for the 2 options b) and c) are kept constant while the time is adjusted to take into account that only the general part of the RCM template would be mandatorily reported for O1 while all parts would need to be reported under O2. In accordance with the requirements in the CSM SMS it is assumed that systems are in place where information relevant for this reporting should be available. Moreover, an important distinction should be made between the templates in Annex III and the corresponding one(s) in the ISS to be used by operators reporting. For both O1 and O2 this reporting is limited to significant consequence events (while in the transitionary phase it is restricted further to serious consequence events). O1 (Occurrence scenarios + RCM reporting for significant consequence events; voluntary reporting for RCM information Part 2-4): Total costs for railway operators under this option would be equal to: **0.108 EUR** = 1721 (significant consequence events) x 1.5 (hours per report) x 42 EUR / hour O2 (Occurrence scenarios + RCM reporting for significant consequence events; RCM information reporting Parts 1-4): Total costs for railway operators under this option would be equal to: **0.289 mln EUR** = 1721 (Significant consequence events) x 4 (hours per report) x 42 EUR / hour **e) Safety level assessment (SL)** Benefits and costs are considered below for the SL assessment part of the CSM ASLP *Benefits:* Benefits have been outlined as part of the identified positive impacts earlier. Key advantages would be the contribution to the GoA / Agency activities as well as serving as input for railway operators (monitoring and auditing of their SMS) and NSAs (supervision of railway operators). It should be noted that this element cannot be undertaken without the

	simple reporting by railway operators. Overall, it is expected that the contribution to the overall benefits of the CSM ASLP package would be relative limited. However, it is expected that benefits would outweigh the costs (see below that the costs are indeed very limited). *Costs:* Costs associated with the SL assessment are largely incurred by the Agency covering resources required to deliver the annual SL assessment. It is expected that the Agency's costs would amount to 25 K EUR per annum. This cost estimate is for managing and monitoring the SL assessment (within the ISS). It does not include costs linked to the Agency's work on the SL results jointly with the GoA. **f) Safety performance assessment (SP)** Benefits and costs are considered below for the SP assessment part of the CSM ASLP. *Benefits:* Benefits have been outlined as part of the identified positive impacts earlier. Key advantages would be the contribution to the GoA / Agency activities as well as serving as input for railway operators (monitoring and auditing of their SMS) and NSAs (supervision of railway operators). It should be noted that this element cannot be undertaken without the self-assessment of maturity undertaken and reported by railway operators. *Costs:* Costs associated with the SP assessment are largely incurred by the Agency covering resources required to deliver the annual SP assessment. It is expected that the Agency's costs would amount to 25 K EUR per annum. This cost estimate is for managing and monitoring the SP assessment (within the ISS). It does not include costs linked to the Agency's work on the SP results jointly with the GoA. **g) Group of Analysts (GoA)** The potential benefits and costs associated with the Group of Analysts (GoA) of the CSM ASLP recommendation are assessed below. *Benefits:* GoA benefits are primarily linked to the possibility of channelling and enriching the inputs received through the railway operators' reporting.

	These inputs are foreseen to be used in a range of GoA activities intended to: (1) identify and evaluate risks; (2) mitigate risks; (3) manage RCMs; (4) support systematic improvement in the management of the RCM PDCA cycle. Moreover, GoA could also support continuously improving the CSM ASLP which may prevent poor implementation issues. In turn this can contribute to more efficiency and effective management of safety in SERA. As such it is expected that GoA will capture a part of both the estimated efficiency and effectiveness gains of the CSM ASLP. Although, it is not possible to apportion the GoA share of the total CSM ASLP benefits it is expected that these will outweigh the costs. *Costs:* Costs would be incurred by the Agency as well as stakeholders participating to the (GoA), notably representatives for the railway sector, national authorities and the Commission (as observer). These costs comprise: • *Agency:* ○ *One-off costs for setting up GoA: 0.1 mln EUR* ○ *Ongoing costs covering travel, catering for GoA meetings: 0.03 mln EUR* ○ *Ongoing staff costs for GoA activities: 0.1 mln EUR* • *Railway sector representatives:* ○ *Ongoing costs covering travel to GoA meetings: 0.03 mln EUR* ○ *Ongoing staff costs for GoA activities: 0.15 mln EUR* • *National authorities:* ○ *Ongoing costs covering travel to GoA meetings: 0.12 mln EUR* ○ *Ongoing staff costs for GoA activities: 0.56 mln EUR* It should be noted that the largest proportion of costs are linked to staff resources for participating in the activities in GoA (the staff time is wider than only participating in meetings). These may be subject to change depending on the precise arrangements for the group. **h) Information Sharing System (ISS)** Benefits and costs are considered below for the ISS part of the CSM ASLP (covering the identified options described earlier)

	Benefits:
	The ISS should be seen as a facilitating element by making railway operators'reporting less demanding in terms resources required. Moreover, the ISS would also support the sharing of information contained in the ISS thereby enabling the activities of the GoA as well as contributing to improved learning among railway operators, NSAs and other stakeholders.
	
	O1:
	Any specific benefits of the ISS are quantified under the other CSM ASLP elements (e.g. lower resources for operators are factored in through assumptions used for the reporting). However, it should be noted that break-even would be achieved provided the ISS would contribute to avoid the accident costs from 0.25 of one fatality (using a Value of Preventable Fatality (VPF) of 3.273 mln EUR).
	
	O2:
	Any specific benefits of the ISS are quantified under the other CSM ASLP elements (e.g. lower resources for operators are factored in through assumptions used for the reporting). However, it should be noted that break-even would be achieved provided the ISS would contribute to avoid the accident costs from approx. 0.53 of one fatality (using a VPF of 3.273 mln EUR).
	
	Costs:
	The main cost elements would concern implementing (one-off) and maintaining (on-going) the ISS for the Agency. In addition, there would be costs (one-off and ongoing) for those NSAs and railway operators deciding to interface their reporting systems to the ISS. It is expected that the costs under O1 would be somewhat lower than for O2 (for the Agency, NSAs and railway operators) given that this version of the ISS would be developed to be aligned with a reduced reporting scope.
	
	O1:
	• *Agency:*
	  ○ *One-off costs for implementing the ISS: 1.5 mln EUR (estimates determined based on O2 assumptions)*
	  ○ *Ongoing costs for maintaining the ISS: 0.3 mln EUR (estimates determined based on O2 assumptions)*
	
	• *Railway operators (apportioned from the estimated costs at country level)*

	○ *One-off costs for setting-up interfaces to the ISS: 0.45 mln EUR (estimates determined based on O2 assumptions)* ○ *Ongoing costs for maintaining the interfaces to the ISS: 0.15 mln EUR (estimates determined based on O2 assumptions)* • *National Safety Authorities (apportioned from the estimated costs at country level)* ○ *One-off costs for setting-up interfaces to the ISS: 0.45 mln EUR (estimates determined based on O2 assumptions)* ○ *Ongoing costs for maintaining the interfaces to the ISS: 0.15 mln EUR (estimates determined based on O2 assumptions)* O2: • *Agency:* ○ *One-off costs for implementing the ISS: 2mln EUR* ○ *Ongoing costs for maintaining the ISS: 0.54 mln EUR* • *Railway operators (apportioned from the estimated costs at country level):* ○ *One-off costs for setting-up interfaces to the ISS: 0.75 mln EUR* ○ *Ongoing costs for maintaining the interfaces to the ISS: 0.3 mln EUR* • *National Safety Authorities (apportioned from the estimated costs at country level):* ○ *One-off costs for setting-up interfaces to the ISS: 0.75 mln EUR* ○ *Ongoing costs for maintaining the interfaces to the ISS: 0.3 mln EUR* **Other costs** *Other ongoing costs – check of application of CSM ASLP (National Safety Authorities)* NSAs would be required as part of their tasks vis-à-vis to check the application of the CSM ASLP by operators (similar to the case for the CSM RA, CSM SMS and CSM MON) and take appropriate enforcement actions as required. *Other ongoing costs – training (Railway operators)* This training should focus exclusively on the new elements in the CSM ASLP without including elements from general safety management or

	other requirements from existing EU legislation. Further details provided in **Annex EcoEv 1** *Other ongoing costs – data quality control and legal handling (Agency)* Further details provided in **Annex EcoEv 1** **Other benefits** Our analysis above has focused on the benefits linked to railway operators, national safety authorities and society (benefits through lower accident related costs). However, other specific stakeholders may also have benefits (notably the list of stakeholders in Section 1.3), e.g. ECMs, railway manufacturers and other national authorities. **Total benefits** These comprise efficiency and effectiveness gains. The efficiency gains are linked to operator savings on resources regarding the monitoring and auditing of the SMS which would benefit from access to an improved information basis that could allow for better targeted monitoring and enhanced learning from accidents and incidents. Overall, it is assumed that there would be operator savings of 1% of the staff costs associated with monitoring and auditing the SMS. An average saving estimate of approx. 2500 EUR per annum per operator is used in the modelling. Given the low base value for the operator costs considered for calculating savings it is considered that this estimate is relative conservative. The effectiveness gains are linked to potential savings in costs for accidents and incidents obtained through improved management of risks. The effectiveness gains would also generate benefits on operator side (e.g. lower damage costs for infrastructure and rolling stock). Overall, it is assumed that there would be reduced accident costs of 0.1% over the considered life time (20 years). This would translate into lower accident costs of between 2.7 and 3.8 mln EUR per annum (equivalent to 1.7 avoided accident per annum in the EU). Overall, an assumed 0.1% savings in accident costs is considered rather conservative. Quantification of benefits for national safety authorities have not been monetized although it is likely that there would be at least potential efficiency gains linked to improved targeting and prioritizing of supervision activities. Further details of the basis for these gains are provided in **Annex EcoEv 1**.

Total benefits and costs

A snapshot of how the disaggregated analysis (options defined per CSM ASLP element) translate into total costs and benefits is provided below for illustrative purposes. It should be noted that the aggregated options defined here as Options 1, 2, 3 and 3* could be established in different ways based on the defined disaggregated options.

Figures given are in mln EUR.

Costs		O1	O2	O3	O3*
SR		0.04	2.66	0.58	0.877
DR		0.11	1.38	0.63	0.11
Self-assessment		0.81	0.81	0.81	0.81
RCM + occ scenarios		0.11	0.29	0.11	0.11
SL		0.03	0.03	0.03	0.03
SP		0.03	0.03	0.03	0.03
GOA (one-off)		0.10	0.10	0.10	0.10
GOA (ongoing)		0.99	0.99	0.99	0.99
ISS (one-off)		2.40	3.50	3.50	3.50
ISS ongoing		0.60	1.14	1.14	1.14
Other (Training, Legal, Data); ongoing		0.37	0.37	0.37	0.37
Total Costs (one-off)		2.50	3.60	3.60	3.60
Total Costs (ongoing)		3.07	7.68	4.68	4.45
Benefits					
Benefits: Efficiency		2.17	2.96	3.29	3.29
Benefits: Effectiveness		2.52	3.43	3.81	3.81
Total benefits		4.69	6.39	7.10	7.10
NPV		€ 19.42	€ (21.17)	€ 29.32	€ 32.41
B/C-ratio		1.4	0.8	1.4	1.5

Sensitivity testing has been performed as part of the analysis with focus on time required for railway operator reporting (SR, DR and RCM / Occ. Scenarios) as well as for the assumed hourly labour cost. The sensitivity testing confirms that the results are relatively robust with respect to those parameters. In particular, a positive NPV is retained with time required for SR of 1 hour (instead of 33'), for DR of 2 hours (instead of 1h30') and for RCM / Occ. Scenarios of 4 hours (instead of 1h30') with reporting level kept as above. For SR of Category B events the test involved a time required of 33' instead of 10'.

Additional sensitivity testing was undertaken to determine the robustness regarding number of reports per event. This would be the

	case if several operators would report the same event. In particular, it was tested whether the NPV remained positive if the average number of reports per event would be 1.5 or 2 (instead of 1 as modelled in the impact assessment). The findings indicate that if the number of reports per event was increased to 2 then the NPV would still be positive.

5. Comparison of options and preferred option

5.1. Effectiveness criterion (options' response to specific objectives)

In this section the effectiveness of the different options will be assessed in terms of their response to the specific objectives, as broken down in the following criteria:

- *SO1: Contribute towards improvements of collective learning[15] after relevant occurrences/accidents/incidents*
- *SO2: Improve collective definition of SERA improvement/ simplification*
- *SO3: Improve level of sharing good practice between actors within a given level (operators / national)*
- *SO4: Structured / harmonised sharing of information between levels operators-National-EU*

These scores take values from 1 to 5 with 1 representing the lowest performance and 5 being the highest performance.

a) Simple reporting of events	*O0*	*O1*	*O2*	*O3*	*O3**
Effectiveness	1	3	2	4	5

Criteria: SO1, SO2, SO3, SO4

The highest ranked options for the simple reporting of events in terms of effectiveness are O3* and O3 (with all do-something options reaching higher levels than O1). This ranking draws on the analysis undertaken in Section 4.1.

b) Detailed reporting of events	*O0*	*O1*	*O2*	*O3*	*O3**
Effectiveness	1	3	2	4	3[16]

Criteria: SO1, SO2, SO3, SO4

The highest ranked option for the detailed reporting of events in terms of effectiveness is O3 (with all do-something options reaching higher levels than O1). This ranking draws on the analysis undertaken in Section 4.1.

c) Railway operators' self-assessment	*O0*	*O1*	*O2*
Effectiveness	1	2	3

Criteria: SO1, SO2, SO3, SO4

[15] The concept of collective learning is considered further in Annex EcoEv 0.

[16] It is foreseen that the combination of O3* for DR and O3* for SR would lead to higher level of effectiveness.

The highest ranked option for railway operators' self-assessment in terms of effectiveness is O2 (with both do-something options reaching higher levels than O1). This ranking draws on the analysis undertaken in Section 4.1.

d) Reporting on occurrence scenarios and RCMs	*O0*	*O1*	*O2*
Effectiveness	1	4	3

Criteria: SO1, SO2, SO3, SO4

On the basis of the qualitative analysis carried out in Section 4.1 it is likely that O1 / 02 have higher levels of effectiveness than O0 with respect to the specific objectives (SO1-SO4). It is expected that O1 is achieving comparatively higher levels of effectiveness than O2 given a more targeted focus for RCM information gathering with flexibility offered to railway operators.

e) Safety level assessment (SL)	*O0*	*O1*
Effectiveness	1	4

Criteria: SO1, SO2, SO3, SO4

On the basis of the qualitative analysis carried out in Section 4.1 it is likely that O1 has a higher level of effectiveness than O0 with respect to the specific objectives (SO1-SO4).

f) Safety performance assessment (SP)	*O0*	*O1*
Effectiveness	1	3

Criteria: SO1, SO2, SO3, SO4

On the basis of the qualitative analysis carried out in Section 4.1 it is likely that O1 has a higher level of effectiveness than O0 with respect to the specific objectives (SO1-SO4).

g) Group of Analysts (GoA)	*O0*	*O1*
Effectiveness	1	4

Criteria: SO1, SO2, SO3, SO4

On the basis of the qualitative analysis carried out in Section 4.1 it is likely that O1 has a higher level of effectiveness than O0 with respect to the specific objectives (SO1-SO4).

h) Information Sharing System (ISS)	O0	O1	O2
Effectiveness	1	2	4

Criteria: SO1, SO2, SO3, SO4

On the basis of the qualitative analysis carried out in Section 4.1 it is likely that O1 / 02 have higher levels of effectiveness than O0 with respect to the specific objectives (SO1-SO4). In particular, Option O2 with a scalable iT-solution would be highest ranked in terms of effectiveness.

5.2. Efficiency (NPV and B/C ratio) criterion

On the basis of the findings from section 4.2, the **overall efficiency** of the various options is rated as follows. The following principle for the scoring is adopted:

- 1 if B/C ratio <1 or NPV <=0
- 5 if B/C ratio >1 and NPV >0

a) Simple reporting of events	O0	O1	O2	O3	O3*
Efficiency	1	5	1	5	5

For all do-something options re. simple reporting with the exception of O2 benefits are expected to outweigh costs. For further details see Section 4.2.

b) Detailed reporting of events	O0	O1	O2	O3	O3*
Efficiency	1	5	5	5	5

For all do-something options re. detailed reporting benefits are expected to outweigh costs. For further details see Section 4.2.

c) Railway operators' self-assessment	O0	O1	O2
Efficiency	1	5	5

For both do-something options (O1 and O2) for operators' self-assessment benefits are likely to outweigh the costs. Section 4.2 provides further details.

d) Reporting on occurrence	O0	O1	O2

scenarios and RCMs			
Efficiency	1	5	5

On the basis of the available information presented in Section 4.2 it is likely that benefits will outweigh costs for the 2 do-something options (O1 and O2) re. reporting occurrence scenarios and RCMs.

e) Safety level assessment (SL)	*O0*	*O1*
Efficiency	1	5

On the basis of the analysis undertaken in Section 4.2 it is considered that for O1 the benefits outweigh any incurred costs

f) Safety performance assessment (SP)	*O0*	*O1*
Efficiency	1	5

On the basis of the analysis undertaken in Section 4.2 it is considered that for O1 the benefits outweigh any incurred costs.

g) Group of Analysts (GoA)	*O0*	*O1*
Efficiency	1	5

On the basis of the analysis undertaken in Section 4.2 it is considered that for O1 the benefits outweigh any incurred costs

h) Information Sharing System (ISS)	*O0*	*O1*	*02*
Efficiency	1	5	5

On the basis of the analysis undertaken in Section 4.2 it is considered that for O1 and O2 the benefits outweigh any incurred costs

5.3. Summary of the comparison

In the following tables the comparison of options is summarized taking into account both the effectiveness and efficiency dimensions established in Sections 5.1 and 5.2.

a) Simple reporting of events	*O0*	*O1*	*O2*	*O3*	*O3**
Effectiveness	1	3	2	4	5
Efficiency	1	5	1	5	5
Overall rating	1	4	1.5	4.5	5

b) Detailed reporting of events	*O0*	*O1*	*O2*	*O3*	*O3**
Effectiveness	1	3	2	4	3
Efficiency	1	5	5	5	5
Overall rating	1	4	3.5	4.5	4

c) Railway operators' self-assessment	*O0*	*O1*	*O2*
Effectiveness	1	2	3
Efficiency	1	5	5
Overall rating	1	3.5	4

d) Reporting on occurrence scenarios and RCMs	*O0*	*O1*	*O2*
Effectiveness	1	4	3
Efficiency	1	5	5
Overall rating	1	4.5	4

e) Safety level assessment (SL)	*O0*	*O1*
Effectiveness	1	4
Efficiency	1	5
Overall rating	1	4.5

f) Safety performance assessment (SP)	*O0*	*O1*
Effectiveness	1	3
Efficiency	1	5
Overall rating	1	4

g) Group of Analysts (GoA)	*O0*	*O1*
Effectiveness	1	4
Efficiency	1	5
Overall rating	1	4.5

h) Information Sharing System (ISS)	*O0*	*O1*	*02*
Effectiveness	1	3	4
Efficiency	1	5	5
Overall rating	1	4	4.5

5.4. Preferred option(s)

Our qualitative and quantitative analyses have highlighted that there are potentially significant benefits to be obtained through promoting increased sharing and learning linked to railway accidents / incidents and management of safety. However, increased level of reporting also brings costs. Key drivers for increased costs are linked to the reporting volume and the time required per reporting item. Therefore, the optimal solution will depend on reconciling these elements with the possible benefits taking into account the trade-offs.
Below, the preferred option per CSM ASLP element is identified on the basis of the earlier analysis:

a) Simple reporting of events

Preferred option would be O3* involving reporting of all significant consequence events, all accidents with consequence higher than 5000 EUR.

b) Detailed reporting

	Preferred option would be O3 with reporting of all significant consequence events together with selected additional events. However, it is noted that a combined approach of O3* for DR and O3* for SR could ensure that resources are optimised for reporting of events. **c) Railway operators' self-assessment** O2 is the preferred option with mandatory reporting of the annual SP self-assessment. **d) Reporting on occurrence scenarios and RCMs** O1 is the preferred choice involving reporting on occurrence scenarios and RCMs limited to all significant consequence events with voluntary reporting for Part 2-4 of the RCM template. **e) Safety level assessment (SL)** O1 is the preferred option with the SL assessment as outlined in the CSM ASLP recommendation. **f) Safety performance assessment (SP)** O1 is the preferred option involving the SP assessment as outlined in the CSM ASLP recommendation. **g) Group of Analysts (GoA)** The preferred option is O1 with a GoA as stipulated in the CSM ASLP recommendation. **h) Information Sharing System (ISS)** O2 is the preferred choice involving a scalable IT solution for the ISS.
5.5. Further work required	Following the adoption of the CSM ASLP further IA work is foreseen regarding possible future changes to be considered within the scope of the Group of Analysts. In particular, it is planned that any proposed change requests from GoA (e.g. amendments / updates of the CSM ASLP annexes) will undergo impact assessment. This will contribute to ensure continuous economic feasibility of the CSM ASLP and controlling any additional administrative obligations and costs for all stakeholders (incl. railway operators and national authorities).

6. Monitoring and evaluation

6.1. Monitoring indicators	The initial proposal for monitoring indicators reflects the CSM ASLP in terms of the foreseen actions by the different stakeholders and the associated impacts. Amendments would be foreseen once the CSM ASLP is adopted: • *Number and types of occurrences reported at operator, national and European levels (information is assumed to be extracted from the ISS in order to determine statistical trends in reporting both in terms level and categories of events)* • *Proportion of reported occurrences that are analysed at operator, national and European levels* • *Number and types of risk control measures reported according to information contained in the ISS* • *Return of experience from the SP and SL assessments* • *Evidence of actions adopted that are linked to reported occurrences, occurrence scenarios and risk control measures* • *Railway accident rate by type of accidents* • *Possible determination of key risk areas in Europe according to the records contained in the ISS and outputs from the GoA* • *Resource requirements for stakeholders to report to the ISS* • *Perceptions among operators, national authorities and European actors concerning the collection, sharing and analysis of occurrences, reportable occurrence scenarios and risk control measures as well as self-assessments of operators* Other elements to monitor closely would be the quality and depth of the data / information provided by railway operators. This includes simple / detailed reporting of events, occurrence scenarios, risk control measures and self-assessments by operators. Further monitoring indicators may be put forward and followed by the Group of Analysts (GoA) in their foreseen role to facilitate the gradual improvement of the functioning and use of the CSM ASLP with particular focus on the annexes, incl. the risk classification method.
6.2. Future evaluations	In accordance with the provision in the Agency Regulation (Art. 8.3) the Agency may conduct *ex post* assessment of the legislation based on its recommendations (e.g. the CSM ASLP). Such assessment would be framed in accordance with the intervention logic concept in line with the European Commission's Better Regulation Guidelines.

Annex EcoEv 0

Collective learning: A briefing note

The understanding of learning and learning processes draws on a number of different fields / disciplines incl. psychology, sociology, economics, organisational theory, human resource development and management studies. In this context the concept of collective learning has been considered in-depth in the available literature, albeit defined and applied from various perspectives. Garavan & Carbery (2012) highlights that collective learning is '*…as a dynamic and cumulative process that results in the production of knowledge*'[17]. They conclude that '*…collective learning can therefore be conceived as an evolutionary process of perfecting collective knowledge*'. In Garavan & McCarthy (2008)[18] a detailed analysis of collective learning is put forward in the context of human resource development demonstrating the complexity of the concept through the emergence in the literature of a multiplicity of collective terms, e.g. organizational learning, strategic organizational learning and the learning organization all covered within the broad term collective learning. Moreover, the interaction between individual learning within the collective or collective-level learning is recognized. The latter point may be particular important in the context of the foreseen learning potential offered in the context of the CSM ASLP.

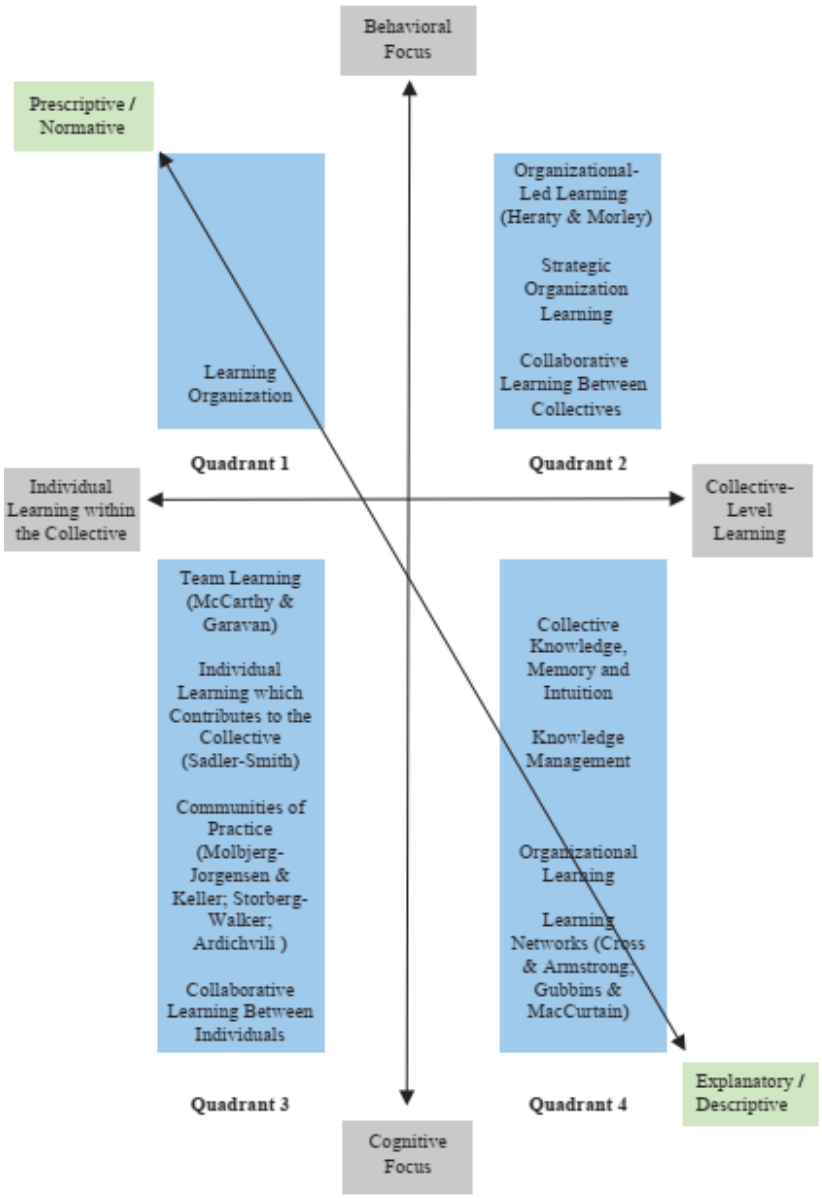
Garavan & McCarthy (2008) also offers a typology for collective learning processes that is useful for elaborating further on the learning processes that may be triggered / supported by the CSM ASLP, see Figure 2 below. In particular, the typology in Figure 2 covers three dimensions: (1) the behavioral or the cognitive; the individual within the collective or the collective in its totality; and whether the conceptualization is perspective and normative or explanatory and descriptive. The elements of collective learning covered in this typology as listed in the four quadrants are all relevant for the CSM ASLP to varying degrees highlighting the broad scope of this concept and its flexibility.

In the following, evidence of the importance of collective learning will be put forward with particular focus on collaborative learning between collectives (Quadrant 1 in Figure 2) as this is particular relevant for the learning within the Group of Analysts (GoA) as well as learning among national authorities and railway operators. In turn, this learning potential may contribute to learning within organisations as well as individual learning among the different teams of a given organisation. Subsequently, this may generate further learning at the collective level.

[17] Garavan, T.N. and R. McCarthy (2012) Collective learning, https://link.springer.com/10.1007%2F978-1-4419-1428-6_136

[18] Garavan, T.N. and A. McCarthy (2008) Collective Learning Processes and Human Resource Development. *Advances in Developing Human Resources*, **10**: DOI: 10.1177/1523422308320473

Figure 2. Conceptualizing Collective Learning Processes in Organizations



Source: Garavan, T.N. and A. McCarthy (2008)

Peters et al. (2010)[19] examines the reasons for firms to collaborate and how this influences what learning is shared, and how such learning is utilized by the firms involved. The paper explores the concept of collective learning, and discusses how the nature and purpose of the interactions between network partners facilitate key learning capabilities. The learning and collaborative concepts are illustrated with examples from the

[19] Peters, L.D., W.J. Johnston, A.D. Pressey & T. Kendrick (2010) Collaboration and collective learning: Networks as learning organisations, *Journal of Business & Industrial Marketing,* https://www.researchgate.net/publication/244069675

automotive industry. On this basis the authors conclude that '*…managing to capitalise on "learning opportunities" within a network is becoming a critical competitive advantage, if not the most critical*'.

González-Benito et al. (2016)[20] examines the role of collaboration in the contribution of innovation to business performance. The paper concludes that the probability of business success increase when firms use collaboration to support their innovation. However, the paper shows that small and big businesses differ in terms of the type of collaboration they engage in.

Alashwal et al. (2019)[21] stresses the importance of inter-organizational learning as a key activity that contributes to organizational development and long-term survival with particular focus on SMEs illustrated by the case of construction companies. In particular, an organization's internal learning is completed by external learning, which occurs through interdependencies among organizations. The process of best learning occurs via dense interconnected social networks.

In Martínez-Costa et al. (2018)[22] the study focus is on the factors that can support inter-organisational learning. In particular, the analysis concludes that an innovative culture positively affects both inter-organisational collaboration and organisational learning. Furthermore, the effect of external collaboration in innovation is mediated by organisational learning, suggesting the importance of acquiring, distributing and interpreting the new external knowledge by employees to ensure a successful development of innovations.

Ozman (2009)[23] provides an overview of the expanding literature on inter-firm networks and innovation recognising that innovation is most effectively undertaken as a collective process in which networks play a central role. A comprehensive perspective on the importance of networks within the economy and society is put forward in Kirman (2011)[24]. In particular, networks and network analysis play a central role in many disciplines and also increasingly within economics. Centrally here is the recognition of the importance of the view of the economy as a system of interacting agents and the emphasis on the structure of the relationship between those individuals. Moreover, a key point is also made about learning '*…instead of thinking of learning only at the individual level, the economy as a whole could be considered as learning …. the communication in the economy as evolving*'.

Kirman's analysis is closely connected with the evolving field of complexity economics, where complex systems are perceived as systems which consist of interacting individuals that change their actions and strategies in response to the outcome they mutually create. Key concepts in this approach include evolution,

[20] González-Benito, O., P.A. Muñoz-Gallego & E. García-Zamora (2016), Role of collaboration in innovation success: Differences for large and small businesses, *Journal of Business Economics and Management*, **17**(4), 645–662.
[21] Alashwal, A.M., W. W. Low & N. A. M. Kamis (2019) Effect of Inter-organizational Learning on Construction SMEs Performance, IOP Conf. Series: Materials Science and Engineering, 495 https://iopscience.iop.org/article/10.1088/1757-899X/495/1/012043/pdf
[22] Martínez-Costa, M., Jimenez-Jimenez, D. & H.A. Dine Rabeh (2018) The effect of organisational learning on interorganisational collaborations in innovation: an empirical study in SMEs, *Knowledge Management Research & Practice*, **17**(3):1-14.
[23] Ozman M. (2009) Inter-firm networks and innovation: a survey of literature, *Economic of Innovation and New Technology*, **18** (1), 39–67.
[24] Kirman, A. (2011) *Complex Economics: Individual and Collective Rationality*, Routledge.

learning and adaptation in contrast to the traditional focus in economic theory / applied economic analysis on equilibrium.

A recent contribution to this field is Beinhocker (2006)[25] where he argues that the economy is a "complex adaptive system," more akin to the brain, the Internet, or an ecosystem than to the static picture presented by traditional theory. Building on these ideas, Beinhocker shows how wealth is created through an evolutionary process. Modern science views evolution not just as a biological phenomenon, but as a general-purpose formula for innovation. As part of this framework learning has a key position including through collective learning where it is noted that '*...organisations provide a vehicle for collective learning. We are accustomed to thinking of learning as an individual activity. However, in a series of experiments during the 1950s, the French scientist Pierre Grassé demonstrated that organisations could learn too* (ERA note: using the examples of termite communities)*…. We cooperatively create artifacts that contain embedded information, and we change our behavior in response to the information embedded in those artifacts'.*

Overall, this briefing note has demonstrated the important role that learning (incl. collective learning) can play in terms of influencing key elements in organisations, economic structures and society. Therefore, it is considered that this is also of relevance for the activities linked to the CSM ASLP irrespective of whether this concern individual operators, national authorities or European stakeholders.

[25] Beinhocker, E.D. (2006) *The origin of wealth: Evolution, complexity and the radical remaking of economics*, Harvard Business School Press.

Annex EcoEv 1

Parameters used in the assessment of costs and benefits	**Value**	**Unit**
One-off cost related parameters		
One-off costs for Information Sharing System (ISS) - Agency	2000	K€
One-off costs for customised interface per country	100	K€
Number of countries retaining own system	15	Number
One-off costs for GoA - Agency	100	K€
Ongoing cost related parameters (p.a.)		
Ongoing costs for ISS - Agency	540	K€
Ongoing costs for customised interface per country	40	K€
Ongoing costs GoA - Agency (work / coordination, travel and catering)	129	K€
Ongoing costs GoA - Other (work, travel)	915	K€
Simple reporting events per report for significant consequence events	33	Minutes
Simple reporting events per report for Category B events	10	Minutes
Detailed reporting events per report	1.5	Hours
Reporting on RCMs and occurrence scenarios per report	1.5-4	Hours
SP self-assessments per assessment	16	Hours
SL and SP Agency assessment, analysis and dissemination	0.5	FTE
Data quality control (Agency). Main responsibiity for data validity are for other stakeholders.	0.5	FTE
Legal matters (Agency)	0.5	FTE
Training (Railway operators) - 1 person every 3rd year (2 days)	16	Hours
Railway operators	1200	Number
Hourly labour costs	42	€
Benefits (p.a.)		
Efficiency gains for railway operators	1	%
Effectiveness gains for society from reduced accident related costs	0.1	%

Annex EcoEv 1 (continued)

Detailed parameters used for the assessment of ISS-related costs	Value	Unit
Implementation costs (one-costs) for the Agency setting up ISS	2000	K€
Ongoing costs for maintaining, updating system:	540	K€
Releases (external resources):	150	K€
Maintenance (external resources):	50	K€
ERA resources (management of the tool, user support, training, maintenance, releases)	240	K€
IT support	50	K€
HW + licenses + hosting	50	K€

Annex EcoEv 1 (continued)

Justification for assumptions on efficiency and effectiveness gains in CSM ASLP IA

Setting out the elements for the assumption for effectiveness gains

- *A 0.1 % gain in effectiveness is assumed in the CSM ASLP IA. This refers to the reduction in accident-related costs in terms of fatalities, serious injuries, material damage to rolling stock and infrastructure, cost of delays and cost to environment. This assumption is based on several elements that will be outlined below (other examples are put forward in the main text of the IA report). It should be noted that examples from other modes of transport / economic sectors should be carefully interpreted in terms of their exact relevance for the railway sector.*
- *Proposal for a Regulation of the European Parliament and the Council on occurrence reporting in civil aviation (2012) includes as evidence that CAST (Commercial Aviation Safety Team) estimated the potential benefits of data-driven strategies to reduce the commercial aviation fatality rate in the United States; http://www.cast-safety.org*
- *In particular, the identified cost savings according to the CAST study would amount to 56 $ per flight (compared to previously 70 $ per flight). The cost savings include: cost avoidance (not profit), including loss of life, aircraft, devaluation of stock prices, insurance fees, and other indirect legal costs. This would imply a percentage reduction of **80 %. In comparison, the CSM ASLP IA assumes a 0.1 % gain in terms of lower accident-related costs (a difference of a factor 800)***
- *Considering that 11 of the EU MS countries have only a basic National Occurrence Reporting system in place largely confined in scope to the reporting requirements of the Common Safety Indicators suggests that there is indeed potential scope for capturing a part of the stipulated effectiveness gains*
- *Jones et al. (1999) provide an account of near-miss management systems successfully applied in the European chemical industries. Two examples of near-miss programs applied at Norsk Hydro's offshore and onshore facilities are studied. In both cases, the results suggest that an increase in near-miss reports can yield improved safety performance. In off-shore drilling, over seven years a 10-fold increase in near-miss reporting corresponded with a **60% reduction in lost time injuries**. In on-shore activities, over a 13-year span, an increase in reporting rates from zero, to one report per two employees per year corresponded with a **75% reduction in lost time injuries**.*
- *A particular example concerns a company (in Saudi Arabia) that was able to increase near miss reporting to about 2000 near misses per year (compared to 25 losses/accidents in the same year). By investigating about 500 of these near misses, they were able to reduce the number of accidents from 65 to 25 in two years and more importantly, their monetary losses were reduced by more than 90% (with a similar drop in injury rates). Further information about gains re. reporting near misses are included in Bridges (2012), see this link: https://www.process-improvement-institute.com/_downloads/Gains_from_Getting_Near_Misses_Reported_website.pdf*

Explanation of mechanics of benefit calculation - effectiveness

- *The benefits are then estimated using the 0.1% as the starting point. In particular, the benefits would be measured as avoided costs (using total annual accident cost in the EU based on the latest economic CSI figures of 3.811 bln EUR). This would translate into annual benefits of 3.811 mln EUR.*
- *The actual calculation is undertaken by determining the number of (CSI) precursors that would be avoided through the CSM ASLP. In particular, it is assumed that 0.1% of annual precursors would be avoided (as the latest figure for total precursors is 14465 in 2018 some 14 precursors could be expected to be avoided with the 0.1% figure).*
- *The next step uses the ratio of total precursors per significant accident as the factor to convert the estimated avoided precursors into estimated avoided accidents. With the latest CSI figures the ratio is 8.40 precursors per significant accident (1721 in 2018). Dividing 14.465 (avoided precursors) with 8.40 would then determine the estimate for avoided significant accidents = 1.72.*
- *The total benefits (avoided accident costs) can then be calculated as: 1.72 avoided accidents x average economic cost per accident (2.21 mln EUR) = 3.811 mln EUR*
- *Overall, our analysis of available studies demonstrates that the assumption put forward is perceived as relative conservative.*

Setting out the elements for the assumption for efficiency gains

- *The CSM ASLP IA assumes a 1% gain in efficiency linked particularly to railway operators (railway undertakings and infrastructure managers). In particular, it is assumed that these gains will relate to the SMS in terms of resources devoted to auditing and monitoring the SMS through better utilisation of process safety concepts incl. improved access to reliable and effective data. (Other examples are put forward in the main text of the IA report). It should be noted that examples from other modes of transport / economic sectors should be carefully interpreted in terms of their exact relevance for the railway sector.*
- *In comparison CCPS (Centre for Chemical Process Safety) considers that the quantitative benefits through adoption of risk-based process safety amount to between **1% and 20% depending on the measure used (productivity, production costs, maintenance costs, capital budget, insurance costs)***
- *UK's Health and Safety Executive prepared a case study on the benefits associated with process safety (Scottish Power). The changes introduced by Scottish Power concerned in particular a process safety framework and KPIs. Scottish Power took a simple view that incidents and near misses were the single source of lagging indicators. It implemented a new incident management process to capture this data and drive consistent investigation of root causes. Reported benefits included **20% reduction in operations and maintenance costs; 22% increase in plant availability; and 25% reduction in plant forced outage rates***
- *Moreover, the Agency's recent report on the return of experience with the CSM for Monitoring (see this link: https://www.era.europa.eu/sites/default/files/activities/docs/report_on_return_of_experience_on_csm_for_monitoring_en.pdf) highlights that:*
    - *A large number of stakeholders across the EU (usually more familiar with the application of rules rather than with risk management), RUs, ECMs and a few IMs, still face difficulties in understanding and correctly implementing the method. Their experience is still negative or insufficient to show a reliable picture*
    - *Almost all stakeholders (RUs, IMs, and ECMs) perceive the CSM for monitoring only as a legal obligation. Although exceptions can be found (e.g. ECMs), usually the stakeholder*

maturity with the risk management and management system concepts is not yet at a level where they would use the monitoring as an active tool for optimising the company costs and competitiveness.

- *It is likely that improved, structured and harmonised occurrence reporting incl. systematic reporting on risk control measures could allow a more optimal use of the CSM by the concerned stakeholders.*
- *Further evidence on the potential for cost savings for operators could be linked to the costs associated with non-injury accidents (e.g. in the area of non-insured elements), further information on this aspect is provided in a UK HSE report (see this link: https://www.hse.gov.uk/research/rrhtm/rr585.htm*
- *Overall, our analysis of available studies demonstrates that the assumption put forward is relative conservative.*

Explanation of mechanics of benefit calculation - efficiency

- *The benefits identified concern expected (operating) cost savings linked to the SMS by railway operators with particular focus on the resources devoted to auditing and monitoring the SMS*
- *Assumed annual unit cost per railway operator for the SMS are based on the UK Department for Transport (2017) Post Implementation Review of the Railways and Other Guided Transport Systems (Safety) Regulation 2006. In particular, the mean average cost figure (from 2016) is 249053 £ (with a minimum value of 1000 £ and a maximum of 1,500,000 £).*
- *Using a Pound – Euro exchange rate of 1.1 would mean that the corresponding figure in Euros would be 273958.3 EUR.*
- *Considering the potential cost savings per operator would amount to 1% implies then that each operator would save 2739.6 EUR. The total figure for all operators in Europe could then be calculated as follows: 2739.6 EUR x 1200 (number of operators in Europe) = 3.287 mln EUR per annum (rounded to 3.3 mln EUR per annum). The actual figure used in the modelling differs between options with the most efficient option achieving the full benefits of 3.287 mln EUR)*

Annex EcoEv 1 (continued)

Explanation for cost assumptions in the CSM ASLP IA

The starting point for the CSM ASLP IA costing was a high level examination of the tasks / obligations put forward in the draft recommendation. This exercise permitted then the identification of cost drivers linked to the different provisions in the recommendation. Obviously, the actual cost values would vary according to the options concerned and their specific content.

The costing for the IA distinguishes between:

- *One-off costs*
- *Ongoing costs*

In both cases there would be staff and IT (HW and SW) related costs.

The main cost drivers considered include:

- *One-off and ongoing costs for the ISS*

These costs are largely incurred by the Agency (with the exception of the implementation and maintenance associated with interfaces to national / operator systems). The cost assumptions listed above have been validated by the Agency's IT department and Registers team considering experience from similar IT systems along with reviewing cost information collected as part of the COR project. It is noted that the implementation of an ISS system is a necessary condition in order to enable the efficient management of data to be processed, analysed and shared between Agency, railway operators, NSAs and other competent authorities.

- *One-off and ongoing costs for the GoA*

The one-off costs concern the Agency, while the ongoing costs are also for the NSAs, Representative Bodies, other participating organisations (e.g. TDG competent authorities). Ongoing costs comprises work, travel and catering. The work stipulated concerns both preparing and participating in GoA meetings as well as undertaking assigned tasks. Overall, the work component of the GoA costs amount to approx. 90% of the total GoA costs.

- *Ongoing costs for simple / detailed reporting of events / occurrence scenarios and risk control measures*

The costs concern principally railway operators. As such this item is a key in terms of administrative burden (as well as this obligation providing the main inputs for collective learning). In contrast, ISS and GoA should rather be viewed as enablers for the effective application of the CSM ASLP. The costs for simple / detailed reporting are determined by:

- *the scope of reporting (i.e. number of reportable events per period, excl. any voluntary reporting);*
- *staff time required per count of simple / detailed reporting / occurrence scenarios and risk control measures. It should be noted that the time required is dependent on the complexity of the templates to be completed*
- *hourly labour costs for staff providing the CSM ASLP reporting*

- *Ongoing costs for self-estimation of safety performance*

The self-estimation of safety performance will be undertaken by the railway operators on an annual basis. In particular, four tables will have to be completed each year covering each of the following elements: (a) Planning of risk control measures; (b) Setting up and operating of risk control measures; (c) Monitoring of risk control measures; (d) Reviewing and adjusting of risk control measures. The costs are determined by:

- *staff time (at operator level) required for completing the four tables. The time required is mainly dependent on the availability of information regarding the required elements of proofs in order to include references to these in the tables of the templates*
- *hourly labour costs for staff providing this reporting*

- *Assessment of SL / SP (operator, national and Union levels)*

The costs are incurred by the Agency and concerns:

- *the periodic estimation of the safety level (SL) per railway operator for each applicable type of operation and the periodic estimation of operator safety performance scores*
- *aggregation of SL and SP estimates (per operator) to national and union levels*
- *analysis of SL and SP information at operator, national and union levels*
- *dissemination of SL / SP information to concerned stakeholders (notably railway operators, NSAs, competent authorities as well as GoA in accordance with rules for sharing information)*

It is foreseen that staff resources will be minimized through the implementation and use of the ISS.

- *Other ongoing costs – training (Railway operators)*

Ongoing resources required for training of staff performing tasks within the CSM ASLP notably railway operators. The costs will be minimized through the use of online training material and guides. This training should only consider the additional elements contained in the CSM ASLP recommendation.

- *Other ongoing costs – data quality control and legal handling (Agency)*

Data quality control is mainly the responsibility of the railway operators as determined in the drafts of the CSM ASLP recommendation. It is expected that the role of the Agency would be relative limited with main quality control being implemented through the ISS using algorithms to check consistency and validity of the data. In addition, there would be Agency resources required regarding legal handling for the data in the ISS and their access.

Further considerations to impacts of the preferred option for railway operators

The impact assessment outlined in the main text provides details of how the main stakeholders are likely to be affected by the different options, incl. the preferred option (see Sections 4.1 and 4.2). However, details re. how impacts may vary within each stakeholder group was not specified. This issue is of particular relevance for railway undertakings given the substantial variation in their size. Below, this aspect will be addressed by setting how impacts may vary according to the size of the railway undertakings. In particular, it will be considered how small RUs could be affected in comparison to the bigger companies. This analysis will distinguish between 2 types of RUs with respect to size: 1) a (relative) small RU; 2) a (relative) big RU. Obviously, company size could be measured using different metrics (staff, traffic volume, revenue, etc.), but as the analysis is developed at a generic level this would not be of relevance.

As a starting point, the following tables provides a baseline in terms of the level of reporting foreseen in the impact assessment. Table A1 provides the overview for SERA as a whole per annum, not per operator and outside the transition period. Table A2 specifies the average level of reporting per operator per annum, while Table A3 shows the average level of reporting per annum in case only 200 operators incur events within the reporting scope. In each table the preferred option (O3*) is highlighted in dark blue.

Table A1. Total level of reporting for SERA per annum

	O1	O2	O3	O3*
Simple reporting	All significant consequence events	All Category A and Category B events	All significant consequence events + additional requested events	All significant consequence events + accidents w. consequences higher than 5000 EUR + Category B events
Number of events	1721	113925	25000	10000 (incl. 1721 significant consequence events) +92000 (Cat B events)
Detailed reporting* (higher than level stipulated in REC – see DR)	All significant consequence events	All Category A events	All significant consequence events + additional requested events	All significant consequence events
Number of events	1721	21925	10000	1721
Occurrence scenarios and RCM	Significant consequence events (part of RCM reporting voluntary)	Significant consequence events (all RCM reporting is mandatory)	N/A	N/A
Number of events	1721	1721	N/A	N/A

Table A2. Average level of reporting for SERA per annum for 1200 operators)

	O1	O2	O3	O3*
Simple reporting	All significant consequence events	All Category A and Category B events	All significant consequence events + additional requested events	All significant consequence events + accidents w. consequences higher than 5000 EUR + Category B events
Number of events	1.4	94.9	20.8	8.3 + 77 (Cat B events)
Detailed reporting* (higher than level stipulated in REC – see DR)	All significant consequence events	All Category A events	All significant consequence events + additional requested events	All significant consequence events
Number of events	1.4	18.3	8.3	1.4
Occurrence scenarios and RCM	Significant consequence events (part of RCM reporting voluntary)	Significant consequence events (all RCM reporting is mandatory)	N/A	N/A
Number of events	1.4	1.4	N/A	N/A

Table A3. Average level of reporting for SERA per annum (in case only 200 operators are reporting events)

	O1	O2	O3	O3*
Simple reporting	All significant consequence events	All Category A and Category B events	All significant consequence events + additional requested events	All significant consequence events + accidents w. consequences higher than 5000 EUR + Category B events
Number of events	1.4	94.9	20.8	8.3 + 77 (Cat B events)
Detailed reporting* (higher than level stipulated in REC – see DR)	All significant consequence events	All Category A events	All significant consequence events + additional requested events	All significant consequence events
Number of events	1.4	18.3	8.3	1.4
Occurrence scenarios and RCM	Significant consequence events (part of RCM reporting voluntary)	Significant consequence events (all RCM reporting is mandatory)	N/A	N/A
Number of events	1.4	1.4	N/A	N/A

The tables demonstrate the low level of total reporting for the preferred option. This translates into a low average level of reporting for railway operators including RUs and IMs. In particular, Table A3 shows the case where reporting is only for a subset of railway operators (200) which may represent the largest entities, e.g. 160 RUs and 40 IMs.

A couple of qualifying statements. Firstly, the precise values given in the table are indicative based on the available information on the scope of reporting considered in the CSM ASLP recommendation. As such these values are order of magnitude with the precise figures being dependent on number of events within the reporting scope.

Secondly, it should be remarked that the future reporting scope may increase compared to the level indicated here. However, as outlined in the recommendation any expansion in reporting scope will be dependent on a clear justification.

Thirdly, Table A3 provides an upper limit of reporting for 200 railway operators and a lower limit (0) for the remaining 1000 operators (for significant consequence events). As a plausible assumption it is likely that normally company size will be correlated with scale of operation and then also to level of annual reporting of events. It follows from this that as a general principle the small railway undertakings would normally report very few events per annum (close to zero) in terms of significant consequence events. For example, a small railway undertaking would not be expected to submit more than 21 reports under simple reporting concerning significant consequence events (as this would be equal to the average number of reports for all operators – and normally the actual number would rather be 0). As highlighted for option O3* it is envisaged here that all Category B events would be reported (albeit limited to 4 fields only – time, place and event type according to the taxonomy). Moreover, operators (incl. the smaller ones) would in O3* report also any accidents for which the consequences are higher than 5000 EUR.

The main message is then that small and big railway undertakings are expected only to be required to report at a relative limited level covering simple reporting, detailed reporting as well as risk control measures and occurrence scenarios. In particular, the expected level of reporting for small railway undertakings is expected to be very low. As a result the additional administrative burden for these railway undertakings is not foreseen to be significant also considering existing obligations on railway undertakings as set out in the EU legislative framework for railway safety (notably Railway Safety Directive and the CSMs applying to RUs and IMs). The same would be the case for bigger railway undertakings albeit with a higher level of reporting compared to small RUs. Both small and big railway undertakings would be able to draw benefits from access to harmonised datasets on events, risk control measures and occurrence scenarios that can contribute to continuous improvement of their management of safety and optimising operational performance. This may be of particular value for small railway undertakings with otherwise limited access to safety relevant information; this could be essential for new entrants with limited practical experience.

As an additional point to consider is the foreseen self-assessment by operators of their safety performance which would apply to all companies in the scope of the CSM ASLP (although this element is voluntary in the transition period). In particular, small RUs would outside the transition period undertake the self-assessment. However, as highlighted in the impact assessment the annual average cost per operator are expected to be relative low and it is likely that the administrative burden would be significantly lower for small RUs than big RUs given a more limited operational complexity.

As a final point of importance it can be considered that for small RUs any one-offs costs for interfacing to the Information Sharing System would be minimised as these companies could use the direct channel for reporting. These companies may not have their own complex IT systems and could instead benefit from the ISS provided platform. For bigger RUs the one-off costs could be higher particularly for those with their own complex IT systems. However, as part of the further elaboration of the CSM ASLP IT solution it is expected that any costs on railway undertakings (incl. IT related one-off costs) are likely to be minimised.

EUROPEAN UNION AGENCY FOR RAILWAYS

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Annex EcoEv 2

Quantitative assessment of retained options

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		PVs
O1 Costs	2.50	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07		44.25 €
O1 Benefits	0.00	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69		63.67 €
O1 Net-benefits	-2.50	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61		19.42 €
O2 Costs	3.60	7.68	7.68	7.68	7.68	7.68	7.68	7.68	7.68	7.68	7.68	7.68	7.68	7.68	7.68	7.68	7.68	7.68	7.68	7.68	7.68		107.99 €
O2 Benefits	0.00	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39		86.82 €
O2 Net-benefits	-3.60	-1.29	-1.29	-1.29	-1.29	-1.29	-1.29	-1.29	-1.29	-1.29	-1.29	-1.29	-1.29	-1.29	-1.29	-1.29	-1.29	-1.29	-1.29	-1.29	-1.29		-21.17 €
O3 Costs	3.60	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68		67.15 €
O3 Benefits	0.00	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10		96.47 €
O3 Net-benefits	-3.60	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42		29.32 €
O3* Costs	3.60	4.45	4.45	4.45	4.45	4.45	4.45	4.45	4.45	4.45	4.45	4.45	4.45	4.45	4.45	4.45	4.45	4.45	4.45	4.45	4.45		64.07 €
O3* Benefits	0.00	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10		96.47 €
O3* Net-benefits	-3.60	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65		32.41 €