Input paper: ARM17-9.1.1

Input paper for the following Committee(s):	check as appropriate	Purpose of paper:
X ARM	□ ENG PAP	**X** Input
□ DTEC	□ VTS	□ Information

Agenda item	9.1
Technical Domain / Task Number	……
Author(s) / Submitter(s)	IALA World-Wide Academy

Research into risk control option benefits and effectiveness methodologies

1 SUMMARY

The *Formal Safety Assessment* (FSA) is a key reference in the IALA Risk Management Toolbox. Step 4 of the FSA is cost-benefit (or cost-effectiveness assessment). Guidance on undertaking this part of the FSA methodology is not currently incorporated within IALA guidance.

Opinion is sought from the Committee on the value of providing IALA specific guidance on cost-benefit and cost-effectiveness techniques for risk control options.

This proposal relates to work item "Develop a method to quantify and evaluate various risk mitigation options" currently included under 1.4 Risk Management in the *Draft Committee Work Programme 2023-2027*

1.1 Purpose of the document

The purpose of this document is to invite the ARM Committee to consider the value of research into current methodologies for estimating the benefits and effectiveness of risk control options, particularly for quantifying non-market value benefits, such as "environmental damage avoided".

This paper suggests that methodologies for benefits calculation that could be applied in conjunction with current IALA risk management tools, would be of use to competent authorities in justifying expenditure on AtoN solutions.

1.2 Related documents

G1018 Risk Management

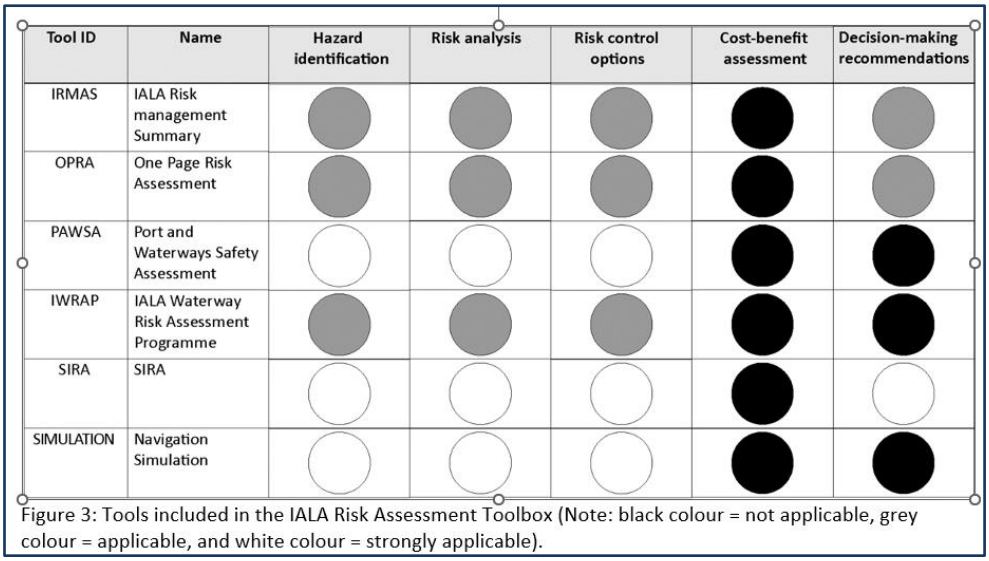
Draft Committee Work Programme 2023-2027

2 BACKGROUND

Guideline G1018 *Risk Management* [1] sets out the principles of the IALA Risk Management Toolbox in alignment with the IMO's *Formal Safety Assessment (FSA)* [2]. G1018 presents each of the tools with reference to the five outline steps presented by the FSA namely:

1. Hazard identification
2. Risk analysis
3. Risk Control Options
4. *Cost-benefit assessment*
5. Decision making recommendations

As highlighted by *Laine et. al [3]* in their IALA Rio conference paper Figure 3, Cost-benefit assessment, although a fundamental step in the FSA, is not currently addressed by the IALA toolbox tools.



Tool ID	Name	Hazard identification	Risk analysis	Risk control options	Cost-benefit assessment	Decision-making recommendations
IRMAS	IALA Risk management Summary	●	●	●	■	●
OPRA	One Page Risk Assessment	●	●	●	■	●
PAWSA	Port and Waterways Safety Assessment	○	○	○	■	■
IWRAP	IALA Waterway Risk Assessment Programme	●	●	●	■	■
SIRA	SIRA	○	○	○	■	○
SIMULATION	Navigation Simulation	○	○	○	■	■

Figure 3: Tools included in the IALA Risk Assessment Toolbox (Note: black colour = not applicable, grey colour = applicable, and white colour = strongly applicable).

Figure 1 Laine et al Figure 3 illustrating, inter alia, absence of cost-benefit assessment methodologies in the IALA Risk Management Toolbox

3 DISCUSSION

3.1 Value of including cost-benefit/effectiveness methodologies within the IALA toolbox

It is proposed that, to claim compliance with the FSA methodology, a navigational risk assessment should incorporate a cost-benefit appraisal (or cost-effectiveness appraisal, depending on market or non-market characteristics).

One of the conclusions of the *Laine et al.* is also that there should be the ability to integrate the findings of navigational risk assessments into organizational processes; the ability to present risk control options in the context of cost benefit or cost effectiveness is a significant factor in facilitating this integration.

This also supports a view that it is easier for managers to justify expenditure when they can present a prioritised list of proposals, with reference to a finite budget, preferably with a risk reduction element that makes the “bang for bucks” explicit.

Adding this piece of the FSA jigsaw with due consideration to current best practice methodologies would facilitate comprehensive consideration of both tangible and intangible benefits in relation to costs, and enhancing risk control decision-making, albeit initially within organizations with a relatively higher level of navigational risk assessment maturity. Justification on more than purely financial terms also assists organizations in assigning expenditure targeted at achieving their contribution to the UN’s Sustainable Development Goals [4]

3.2 Current methodologies used for cost/benefit

It is worth defining the fundamental difference between cost-benefit and cost-effectiveness in this context. Cost *benefit* is a direct monetary comparison e.g., cost vs income or cost vs clean up avoided. Cost

effectiveness may not be monetary, examples include cost vs risk reduction, health improvement, or environmental damage averted.

Some brief examples of benefit or effective outcome calculation techniques are presented in Table 1:

Table 1 Examples of benefit/effective outcome calculation

Benefit/Effective outcome	Example of how to monetise
Value of a life (loss of life/injuries averted is the benefit)	$ 3 million (see FSA Appendix 7, Table 2 for application)
Oil spill compensation (environmental damage averted is the benefit)	$ 67,275 x $V^{0.5893}$ where V is the oil spill in tonnes (see FSA Appendix 7, Table 1 for application, 2009 figures)
Loss of ability to operate a port (ability to continue operation is the benefit)	Costs contractually incurred regarding loss of income and liability if a port is out of operation for a range of times e.g., 2 hours, 12 hours, 48 hours
Cost of an accident (accident costs averted is the benefit)	Historic past incident data in area to see what the implications were of maritime incidents e.g., extended anchorage, inability to operate port, loss of vessel, previous third-party insurance claims

As referenced in Table 1. The FSA assigns monetary benefits in its Appendix 7 to e.g., the value of a life and the cost of clean up, but these are still approximate and temporally outdated.

When we look at purely financial benefits of e.g., costs vs income, we are making a direct monetary comparison; when we compare our costs to say the amount of environmental damage averted, the benefits might not be so easy to quantify in monetary terms, so we can only estimate using alternative valuation techniques.

For example, an undesirable vessel related incident in coastal waters could involve damage to commercial fisheries which could be quantified using market valuation techniques. In such a case It is equally important to consider societal value that could have been lost due to the navigational incident. Estimating the societal loss of the incident is challenging when considering non-market derived values.

An example of non-market valuation technique is described by Arrow et al [5]. They discuss the principle of "willingness to pay" (WTP)[1] as a means of determining the benefits of environmental damage averted. Their paper describes the "contingent valuation" (CV) technique; attributing monetary costs to natural assets based on social surveys to determine society's valuation of that asset.

There are highly likely to be other examples encountered and/or utilised by Committee members.

In conclusion it is suggested that it would be a useful exercise to:

- determine other examples of benefit/effectiveness calculation techniques that may be in use within the maritime industry or comparable industries; and
- consider which of these techniques could be manipulated to provide useful guidance in navigational risk assessment, as part of the IALA Risk Management Toolbox.

1 The National Oceanic and Atmospheric Administration (NOAA) library contains numerous WTP study sources and could be a useful source of information [6])

4 ACTION REQUESTED OF THE COMMITTEE

The Committee is invited to:

1) Decide if it would be of benefit for the ARM Committee to provide guidance on calculating cost-benefit and cost-effectiveness as part of the IALA Risk Management toolbox.

2) Depending on the outcome of 1), agree a plan with an aim of determining methodologies and recommend techniques that could form part of the toolbox.

5 REFERENCES

[1] IALA. (2022) Guideline G1018 Risk Management

[2] IMO. (2013). Revised guidelines for formal safety assessment for use in the IMO rule-making process.

[3] Laine, V, Goerlandt, F & Bolt, E. (2023) IALA Risk Management Guideline: Theoretical Basis, Risk Assessment Tools and Future Needs

[4] UN. (2023) 17 Goals to Transform Our World; How your company can advance each of the SDGs https://unglobalcompact.org/sdgs/17-global-goals accessed 27/09/2023

[5] National Oceanic and Atmospheric Administration (NOAA). (2001). Report of the NOAA Panel on Contingent Valuation

[6] NOOA. https://repository.library.noaa.gov/gsearch?terms=willingness%20to%20pay&start=20)