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Search on the Marine accidents Analysis Methods

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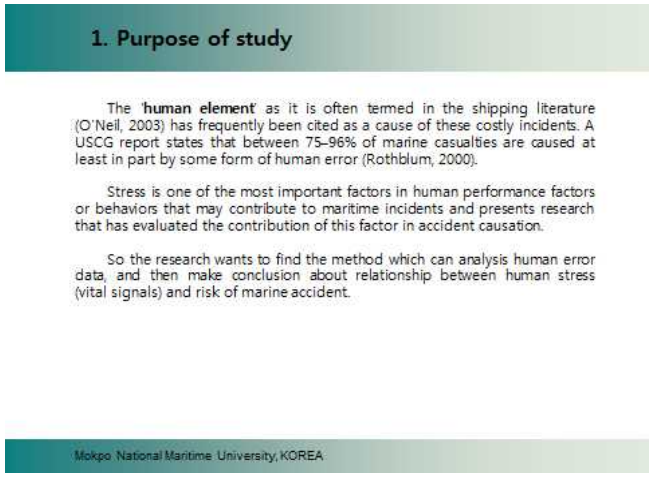
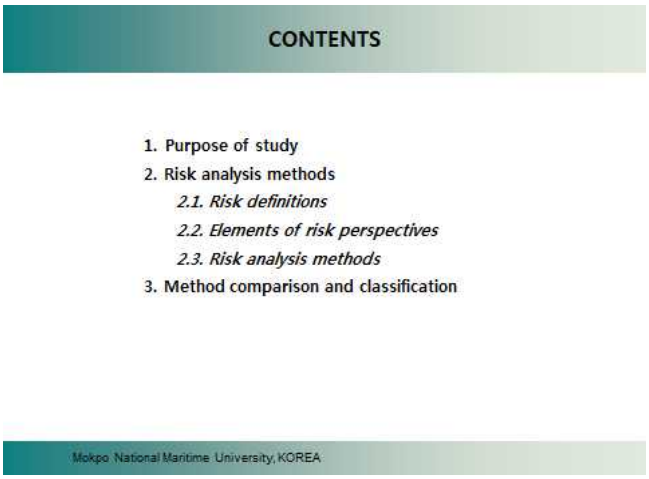
Abstract : *Nowadays, the issue of maritime safety is an extremely important issue in the maritime industry and Human' Stress is one of the biggest causes of maritime accidents. The purpose of this study was to research and compare the risk marine accidents analysis methods and find the methods which used to analysis data of the human' stress and obtained the relationship between it and the risk o maritime accidents.*

Key Words : *Human element, Risk, Probability, Application, Method.*





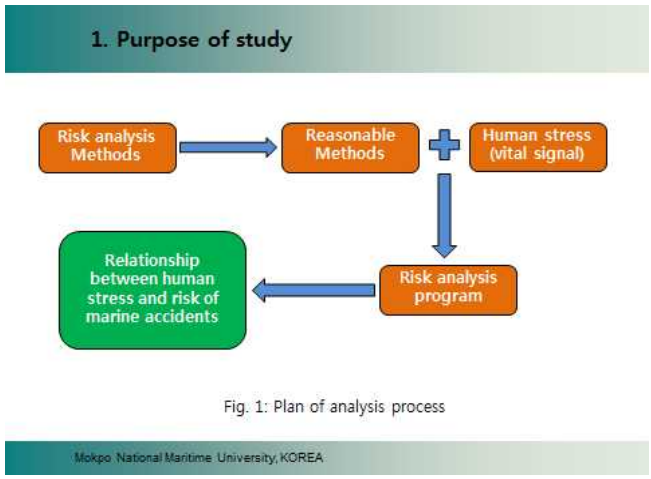


Fig. 1: Plan of analysis process

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2. Risk analysis methods for maritime transportation

2.1. A classification of risk definitions

	Risk definition classes	Abbreviation
D1	Risk = Expected value	R=EV
D2	Risk = Probability of an (undesirable) event	R=P
D3	Risk = Objective uncertainly	R=OU
D4	Risk = Uncertainly	R=U
D5	Risk = Potential/possibility of a lost	R=PO
D6	Risk = Probability and scenarios/consequences	R=P&C
D7	Risk = Event or consequence	R=C
D8	Risk = Consequences/damage/severity+uncertainty	R=C&U
D9	Risk = Effect of uncertainty on objectives	R=ISO

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2.3. Risk analysis methods for maritime transportation

a concise overview is given of the maritime transportation risk analysis applications, i.e. applications analyzing the accidental risk of maritime transportation in a given waterway or sea area. The review covers the period from 1970 to 2014, using a total of 58 applications. For each analysis, following characteristics are determined in tables.

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2.2. Elements of risk perspectives

Three aspects are considered: the measurement tools (probabilities, indicators, fuzzy numbers,...), the scope of the analysis (events or events and consequences), and the tools applied to convey information regarding the confidence in the analysis (uncertainty and bias measures)

Definition Rationale of the measurement tool	
P_r	Frequentist probability Fraction of time a specified outcome occurs in an in principle infinite number of repeated tests A distinction is made between Pf as a concept and its measurement Pf which is derived from empirical data, a thought-constructed "repeated experiment" or a repeated evaluation of an engineering or statistical model.
P_s	Subjective probability Degree of belief of an assessor based on evidence available to him/her, i.e. a measure of outcome uncertainty.
P_x	Modelled probability Calculated probability measure based on a data- or judgment-based model, mapping non-probabilistic predictor variables to a probability (or probability-like) scale.

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Method N° Year	Formula	RA	Risk definition
M1 1974	$R\sim(P_f, A)$	I	Study effect of visibility on the number of collisions and groundings in a waterway
M2 1974	$R\sim(P_f, A)$	I	Determine the expected number of collisions in a sea area
M3 1995	$R\sim(I_{QL}, A)$	II	Evaluate collision risk in a waterway environment
M4 1995	$R\sim(P_f, A, C)$	I	Determine the frequency and consequences of collision and grounding in a waterway
M5 1995	$R\sim(P_x, A, C)$	I	Determine the risk of collision in a waterway
M6 1998	$R\sim(P_f, P_x, A, C \mid [U_{QL}])$	IV	Quantify effect of risk reduction measures on oil spills due to ship accidents
M7 2000	$R\sim(P_f, P_s, A, C \mid [U_{QL}])$	II	Determine occurrence frequency and consequences of various accident types in a sea area
M8 2000	$R\sim(P_f, P_x, A, C)$	IV	Quantify effect of risk management interventions on risk of oil spills due to ship accidents

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I_{QU}	Quantitative indicator A ratio- or interval scale measure of a characteristic of the system, used as a proxy of the occurrence of events and/or consequences. The quantitative measure is derived from data, or by applying a model in data.
I_{QL}	Qualitative indicator A categorical or ordinal measure of a characteristic of the system, used as a proxy of the occurrence of events and/or consequences. The qualitative measure is based on a judgement by an assessor, obtained either through direct judgment or derived from a mathematical model
F	Fuzzy number A measure derived from the degree to which a specific instance belongs to a certain category, i.e. the degree of similarity between the instance and the category
A	Event A specific (defined) state of the world and how that specified state changes or develops over a time interval
C	Consequence A specific type of event, connected to another event through a causal relation, i.e. under conditions of constant conjunction, temporal succession and spatial propinquity

3. Compared and applied classification of approaches to analysis science

The general approaches to risk analysis are further distinguished by considering a number of criteria used to classify the risk analysis applications. The presented classification distinguishes eight classes, see Fig. 2. Following criteria are considered for classifying risk analysis applications to these classes:

I	Strong realist	CR1	Focus on underlying true risk
II	Moderate realist	CR2	Data and engineering/ scientific models
III	Moderate realist with uncertainty quantification	CR3	Expert judgment
IV	Scientific proceduralist	CR4	Non-epistemic value
V	Precautionary	CR5	Lay person's judgment
VI	Moderate constructivist with uncertainty evaluation	CR6	Uncertainty assessment
VII	Moderate constructivist	CR7	Stakeholder involvement
VIII	Strong constructivist	CR8	Contextual attributes
		CR9	Link to decision making

All the methods are compared with the data of human errors (through vital signals) and choose the most reasonable methods to analysis the risk of accidents.

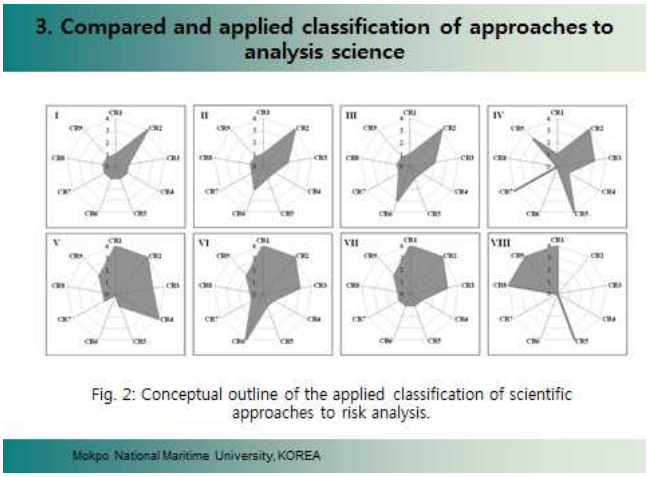

Fig. 2: Conceptual outline of the applied classification of scientific approaches to risk analysis.

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