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Occupational Safety in Norwegian Maritime Transport: a Study of Respondents from Cargo and Passenger Vessels

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Background

- Sea transport is central to world trade, as it carries about **90% of internationally traded produce**.
- Seafaring is still among the **most hazardous** occupations.
- The study focuses on **coastal cargo** transport (small cargo vessels) and **border crossing passenger** transport (roll-on/roll-off passenger or cruise ferries).
- Previous research indicates that **passenger vessel** crews have a **higher risk** than **coaster** crews of all occupational **accidents**, but a substantially **lower risk** of **serious injury** and **fatal** accidents.



Objectives

- Compare **organizational safety culture** and **working conditions** in Norwegian cargo and passenger transport at sea.
- Examine **safety outcomes** (safety behaviours and crewmember accidents) of safety culture and working conditions in the two sectors.
- Discuss how safety culture and working conditions are **influenced** by the **framework conditions** of the two sectors.



The SafeCulture project

SafeCulture - *Safety culture in private and professional transport: examining its influence on behaviours and implications for interventions*

Aims to explore safety culture in land and sea based, professional and private transport in Norway and Greece.

Funded under the “Transport 2025” program of the Norwegian Research Council.

Duration: 36 months (Jan 2016 – Dec 2018)

Partners:  Institute of Transport Economics
Norwegian Centre for Transport Research



Research questions

- How much does **membership in different sociocultural units** (e.g. nation, region, peer-groups, sector, organizations) influence individual transport safety behaviour in professional and private transport?
- How much does TSC influence safety behaviour and outcomes relative to **known risk factors** like gender, age, experience, technology and infrastructure?
- How can the knowledge on group membership influencing TSC and the relative importance of TSC as a **predictor** of transport safety **behaviour** and safety **outcomes** be used to increase transport safety?



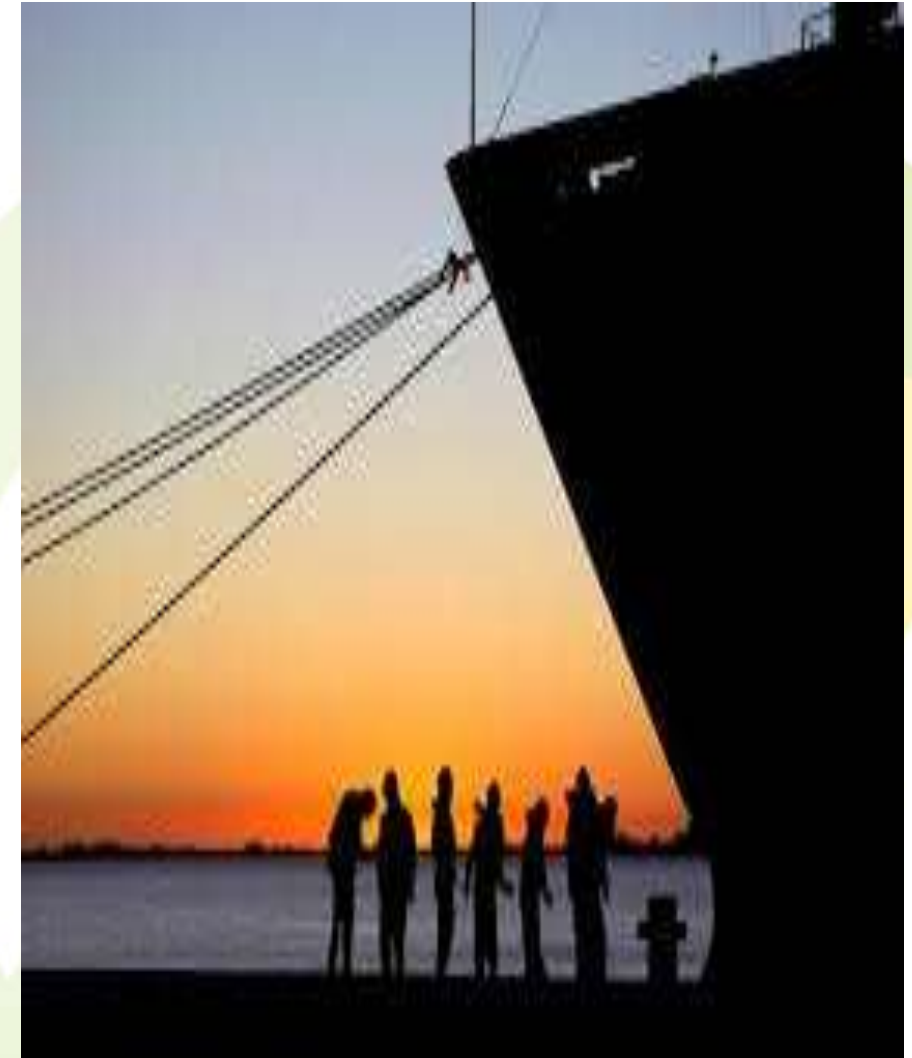
Professional maritime transport survey

- **Background variables** (15 questions)
(e.g. gender, age, vessel type, work schedule, etc)
- **Safety performance** (5 questions):
 - **Safety behaviours**
(e.g. How often do you think you tend to violate procedures to get the job done for every 100 working days/nights on board?)
 - **Work place safety assessment**
(All in all, how do you assess the safety of your work place situation?)
 - **Safety compromising fatigue**
(Sometimes I am so tired during working hours that safety is compromised?)
 - **Work accidents experience**
(Have you been injured in your work on board during the last 2 years?)
- **Working conditions** (4 questions)
(e.g. How often do you think you tend to work more than 16 hours in the course of a 24-hour period for every 100 working days/nights on board?)
- **Organisational safety culture** (10 questions from the GAIN-scale)



Professional maritime transport sample

- **On-line survey** distributed by **Norwegian shipping** companies to all employees working on board vessels.
- In total, **157 respondents** completed the survey; 73 (47%) worked in **cargo** transport, and 84 (53%) worked in **passenger** transport.
- Eight per cent (8%) of the 157 respondents are **women**.
- Ninety-one per cent (91%) are **Norwegian**, 6% are from another Nordic country, while 3% are from other countries, mainly Western European.



Results - Organisational Safety Culture

- Respondents **younger** than 26 years **rate** the organisational safety culture level **lower** than other age groups.
- The organizational safety culture score is slightly **higher** in **passenger** shipping than in cargo shipping.
- The more respondents agree with the statements on work pressure and fatigue the **lower safety culture levels** they report.

	Age group	Position	Shipping company	Vessel type	Safety compromising fatigue	Work pressure
1	Younger than 26 years	Captain	1 Cargo	Bulk vessel	Totally disagree:	Totally disagree:
	41.3	44.8	44	40.1	45	44.8
2	26-35 years	Deck officer	2 Cargo	General cargo	Disagree somewhat:	Disagree somewhat:
	42.1	42.6	41.2	44.3	42.2	42.2
3	36-45 years	Deck crew	3 Cargo	Tank vessel	Neither/nor:	Neither/nor:
	43.5	43.6	44.2	36.5	41.6	38.8
4	46-55 years	Chief engineer	4 cargo	Live fish carrier	Agree Somewhat:	Agree Somewhat:
	43.4	45.5	42	44.4	37.5	41.3
5	Older than 56 years	Engine officer	5 cargo	Other cargo	Totally agree:	Totally agree:
	46.7	42.6	38.1	40	38.3	29.7
6	-	Engine crew	6 Passenger	Passenger line 1	-	-
	-	40.1	44.4	43.3	-	-
7	-	Catering	-	Passenger line 2	-	-
	-	45.2	-	44.4	-	-
8	-	Apprentice	-	Passenger line 3	-	-
	-	41.5	-	46.5	-	-
9	-	Other	-	-	-	-
	-	43.2	-	-	-	-
P value	.039	.437	.001	.000	0.000	0.00

Results – Demanding Working Conditions

- There are significant **differences between** respondents in different shipping **companies**.
- The **passenger** shipping company has the lowest score, indicating the **least demanding** working conditions.
- Respondents who report **higher** levels of safety **compromising** work pressure, experience **more demanding** working conditions.

	Age group	Position	Shipping company	Vessel type	Safety compromising fatigue	Work pressure
1	Younger than 26 years 6.8	Captain 8.1	1 Cargo 7.2	Bulk vessel 7.3	Totally disagree: 6.2	Totally disagree: 5.7
2	26-35 years 6.1	Deck officer 6	2 Cargo 6.7	General cargo 6.9	Disagree somewhat: 6	Disagree somewhat: 7
3	36-45 years 6.3	Deck crew 5.4	3 Cargo 7.6	Tank vessel 7.3	Neither/nor: 7.8	Neither/nor: 8.5
4	46-55 years 6.5	Chief engineer 7.3	4 cargo 8.8	Live fish carrier 7.7	Agree Somewhat: 6.9	Agree Somewhat: 10.2
5	Older than 56 years 6.8	Engine officer 7.1	5 cargo 7.6	Other cargo 8.3	Totally agree: 7.5	Totally agree: 11.5
6	-	Engine crew 7.3	6 Passenger 5.6	Passenger line 1 5.9	-	-
7	-	Catering 6	-	Passenger line 2 5.5	-	-
8	-	Apprentice 7.2	-	Passenger line 3 5.2	-	-
9	-	Other 5.7	-	-	-	-
P value	.947	.256	.018	.061	.332	.000

Results – Safety Outcomes

- The **younger** respondents are, the **less safe** are their behaviours.
- Respondents from the shipping company involved in **passenger** transport have the **safest** behaviours.
- **Tank vessel** respondents have the **highest score** on the unsafe behaviour index.
- The **more demanding working conditions** the respondents experience, the **more unsafe behaviours** they are involved in.

	Age group	Position	Shipping company	Vessel type	Demanding working conditions	Work pressure
1	Younger than 26 years	Captain	1 Cargo	Bulk vessel	3-7 points	Totally disagree:
	9.8	7.7	8.3	8.7	7.2	6.9
2	26-35 years	Deck officer	2 Cargo	General cargo	8-12 points	Disagree somewhat:
	9.3	9.3	8.8	8.3	9.3	8.7
3	36-45 years	Deck crew	3 Cargo	Tank vessel	13-21 points	Neither/nor:
	8.6	7.2	8.7	11.8	11.7	9.8
4	46-55 years	Chief engineer	4 cargo	Live fish carrier	-	Agree Somewhat:
	6.8	5.3	12.5	9.2	-	13.7
5	Older than 56 years	Engine officer	5 cargo	Other cargo	-	Totally agree:
	5.6	9	11.4	10.7	-	17.3
6	-	Engine crew	6 Passenger	Passenger line 1	-	-
	-	7.5	6.6	6.9	-	-
7	-	Catering	-	Passenger line 2	-	-
	-	6.5	-	6.1	-	-
8	-	Apprentice	-	Passenger line 3	-	-
	-	11.7	-	6.6	-	-
9	-	Other	-	-	-	-
	-	6.7	-	-	-	-
P value		.004	.077	.000	.002	.004

Results – Personal Injuries On Board

- **Age group** contributes **negatively** and significantly to the risk of having a **personal injury**.
- The **unsafe behaviours** index contributes **positively** and significantly to **personal injuries**.
- There is a **close** association between **work pressure** and **unsafe working** behaviours on board the studied vessels.

Variables	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7	Step 8
Age group (>26 years=0, other=1)	- 2,226** *	- 2,106***	- 2,072***	- 2,086** *	- 2,038** *	- 2,051***	- 2,051***	- 2,120***
Position/line of work (Apprentice=0, other=1)		-,418	-,145	-,174	-,256	-,259	-,261	-,204
Unsafe behaviours index			,098**	,100**	,102**	,097**	,096*	,115*
Sector (passenger=0, cargo=1)				-,085	-,318	-,364	-,364	-,328
Sub-sector (Live fish carrier=0, other=1)					-,508	-,491	-,491	-,391
Demanding working conditions index						,032	,031	,030
Sometimes I feel pressured to continue working, even if it is not perfectly safe							,002	,048
Organisational safety culture								,033
Nagelkerke R ²	.158	.159	.201	.201	.208	.210	.210	.214

* p < 0.1 ** p < 0.05 *** p < 0.01

Results – Unsafe Behaviours

- Respondents in the **passenger** transport sector in average have **safer behaviours**, with fewer violations, risk taking/acceptance.
- The **more work pressure** the respondents experience, the **more** likely they are to be **involved in unsafe behaviours**.
- The **higher organizational safety culture** scores the respondents report, the **less unsafe** are their **behaviours**.

Variables	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
Age group (>26 years=2)	.158*	.090	.059	.085	.089	.081	.026
Position/line of work (Apprentice=2)		.140	.094	.065	.065	.113	.122
Sector (cargo=1, passenger=2)			-.280**	-.238**	-.178*	-.159*	-.160**
Sub-sector (Tank=2)				.139	.142*	.145*	.021
Demanding working conditions index					.212**	.064	.079
Sometimes I feel pressured to continue working, even if it is not perfectly safe						.381** *	.219** *
Organisational safety culture							-.385** *
Adjusted R ²	.018	.026	.095	.105	.142	.261	.367

* p < 0.1 ** p < 0.05 *** p < 0.01

Results – Organisational Safety Culture

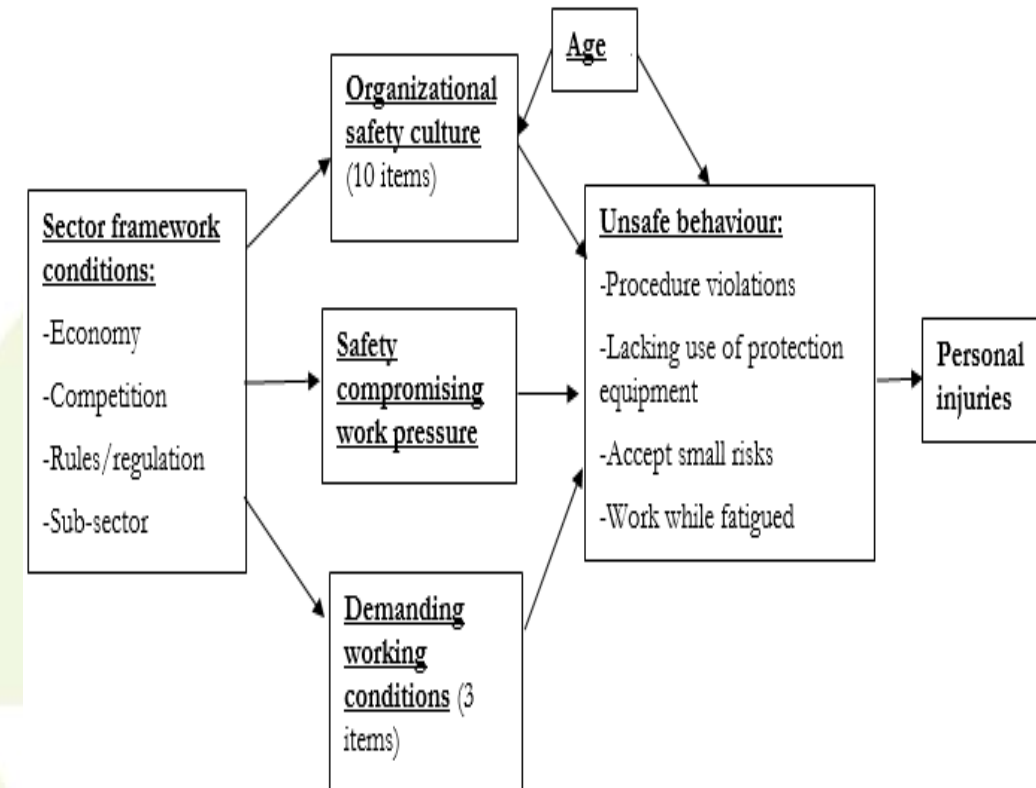
- Age group contributes **positively** and significantly to organisational safety culture.
- The **sub-sector** contributes **positively** and significantly to organisational safety culture.
- **Safety compromising work pressure** contributes **negatively** to organisational safety culture.

Variables	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6
Age group (>56 years=2)	.195**	.192**	.171**	.187**	.196**	.164**
Position/line of work (Chief engineer=2)		.046	.079	.078	.076	.100
Sector (cargo=1, passenger=2)			.181**	.103	.068	.066
Sub-sector (Passenger line 3=2)				.195**	.188**	.168**
Demanding working conditions index					-.128	.021
Sometimes I feel pressured to continue working, even if it is not perfectly safe						-.368***
Adjusted R ²	.032	.027	.053	.079	.088	.196

* p < 0.1 ** p < 0.05 *** p < 0.01

Discussion

- Crew members in the coastal **cargo** sector rate their **organizational** safety culture **lower** than those in the **passenger** transport sector.
- **Safety culture** is closely related to **working conditions**.
- **Young age** (<26) is associated with **occupational** accident risk on board.
- Work **pressure** and **poor organizational** safety culture are closely related to **unsafe** working behaviours.



Future steps

- The present results must be interpreted with caution, as they are based on a relatively **limited sample**, and **low numbers**.
- Examine how **organizational** safety culture can be employed to reduce the **impact of negative framework conditions** in maritime transport on occupational safety.
- Use **exposure measures** or a measure of risk to explore higher share of injuries in coastal cargo.
- Check more closely the different **work processes** leading to injuries on board cargo and passenger vessels.
- Measure the influence of the different **framework conditions**.





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