

An Assessment of the Qualification and Competency of Maritime Casualty Investigators of the Maritime Safety Services Command: Inputs for Enhancement

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Abstract

This paper presents an assessment of the qualification and competency of maritime casualty investigators within the Maritime Safety Services Command (MSSC) of the Philippine Coast Guard (PCG). The objective of this assessment is to identify areas for improvement and provide inputs to enhance the capabilities of the maritime casualty investigators. Respondents of the study were 57 maritime casualty investigators who have undergone a 10-day training on maritime casualty investigation. They were assigned to different Maritime Safety Services Units and Coast Guard Districts all over the Philippines. The study evaluated the educational background, training programs, and practical experience of the investigators, along with their knowledge of relevant maritime laws and regulations. Findings highlighted potential gaps in qualifications and competencies, such as the need for specialized training in accident reconstruction. This is a field that demands deep understanding of various factors influencing maritime accidents. Additionally, the assessment considers the use of advanced technologies and methodologies in maritime casualty investigations. These results suggest that the level of education alone may not be a reliable predictor of proficiency in the assessed competencies, warranting further exploration of additional factors that may contribute to the development of maritime investigative skills.

Keywords: maritime safety, casualty investigation, qualification, competency, training, enhancement



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INTRODUCTION

Maritime casualties and maritime incidents can have many causal factors and the underlying safety issues often exist remote from the casualty site. Proper identification of such issues requires timely and methodical investigation, going far beyond the immediate evidence in the search for conditions that may cause future occurrences. Maritime casualty or

maritime incident investigations should therefore be seen as a means of identifying not only the accident events but also safety deficiencies in the overall management of the operation from policy through to its implementation, as well as in regulation, survey, and inspection. Maritime casualty investigation is very important because the objective of it is to improve maritime safety by implementing the safety recommendations made in the investigation to avoid the recurrence of similar accidents in the future. Therefore, the success of the maritime casualty investigations lies in the competence of the maritime casualty investigators attending such maritime casualty. The Maritime Casualty Investigation Services (MCIS) shall conduct just and timely investigations on maritime casualty and maritime incidents; to gather, analyze and preserve facts and evidence for the use of appropriate hearing bodies and to safely keep records and statistics of maritime casualties and maritime incidents to generate viable recommendations to avert the occurrence of similar incidents. One of its functions is to conduct Maritime Casualty Investigation Training for all Philippine Coast Guard (PCG)

personnel. The training focuses on the newly approved standing operating procedures HPCG/CG-8/MSSC SOP Number 04-22 dated 29 April 2022, or the Revised Guidelines in the Conduct of Maritime Casualty and Incident Investigation and on the International Maritime Organization - Casualty Investigation Code (IMO-CIC).

To date, there is no specific provision in the Philippines on how to evaluate the competence of the maritime casualty investigators for them to conduct and manage maritime casualties and maritime incidents investigation efficiently and effectively. Although there has been significant development in the Maritime Casualty Investigation Reports (MCIR) after the participants from different Maritime Safety Services Units (MSSU) and Coast Guard Districts completed the 10-day Maritime Casualty Investigation Training, it is still observed that there are still areas which need to be improved particularly in the analysis section and formulating of the safety recommendations in the MCIR. This is because not all of the participants who completed the said training have a maritime background or have been assigned in the PCG vessel or have experience in commercial vessels. In addition, there is no approved course for the Maritime Casualty Investigators Specialist Course which could fill in the gaps, especially in those areas that are highly technical like ship's routine, safety and security procedures, pieces of training and drills, publications, voyage plan, and navigational safety, crew's qualifications, working hours, communications and VDR, passenger and cargo handling safety procedures, about the International Safety Management (ISM) Code and Standards of Training, Certification, and Watchkeeping (STCW) Convention.

This research, therefore, addresses the issues on how to assess the qualification and competency of maritime casualty investigators of MSSC. Pondering on the above aim, the following are the objectives of the study:

1. To determine the qualifications of the present maritime casualty investigators of the Maritime Safety Services Command.
2. To yield the performance of the present maritime casualty investigators in the general investigation technique test clustered according to Ethics (Ethics in doing investigation), Attention to detail, Control, Courage, Critical thinking, Curiosity, Interviewing, Patience, Research, Surveillance, and Writing.
3. To determine the investigative competency of the maritime casualty investigators through self-assessment based on Personal Safety and Knowledge of Safety Practices; Evidence Collection; Snap chart Construction; Root Cause Analysis, Corrective Action Development, and Attitude and Teamwork.
4. To determine if significant relationship exist between the qualification and general investigation technique test; and between the qualification and investigative competency self-assessment of the maritime casualty investigators.

Results of the study will be generally utilized to contribute in the effective and efficient conduct of maritime casualty investigation. It will also be the basis in the development of a course framework for the Maritime Casualty Investigators Specialist Course to standardize the approach of the maritime casualty investigators in the conduct of maritime casualty investigations and will also fill the gaps in the knowledge of the non-maritime participants on the said course.

LITERATURES

Qualifications of Maritime Casualty investigators. The IMO has yet to set mandatory standards for marine safety investigators but according to Foaj (2021), investigators need the following skills and values to do their work well: knowledge and values; communication; conduct of investigators; legislation; evidence; and, conclusion-making and report writing.

For knowledge and values, investigators should understand the legal framework, jurisdiction, procedure, and subject matter of the investigation. With respect to communication, investigators should communicate effectively using plain language (language readily understood by all), and working with interpreters, including American Sign Language (ASL) and braille, as needed. In the conduct of investigations, investigators should investigate without influence or interference from outside parties. Relative to legislation, investigators should understand, use, and apply to govern legislation and other applicable legislation, contracts, or policies. In terms of evidence, investigators should identify and gather the relevant evidence. Lastly, in conclusion-making and report writing, investigators shall show good judgment in deliberating and reaching conclusions.

Competency of Maritime Casualty Investigators.

According to the study of Farid and Elashkar (2020), in the review of marine safety investigations success barriers, unqualified investigator is one of the barriers to a successful marine safety inquiry. Investigations into marine safety should be conducted by qualified investigators who are skilled in investigational techniques, knowledgeable of national and international laws about marine safety investigations, in possession of the appropriate tools required for the investigations, capable of interviewing witnesses, capable of analyzing the causes and offering recommendations, and knowledgeable in the completion of investigation forms. As the flag administration and coastal State authority, MARINA and PCG must develop and put into practice procedures for the admission, training, education, updating, and evaluation of investigators that are appropriate for the duties they are permitted to carry out (MARINA, 2021). The value of establishing partnerships with international organizations, academic institutions, and industry experts should be emphasized (Rodriguez & Lim, 2021). According to the study (Cassama, 2015), a skilled person in interviewing techniques should conduct witness interviews for the revelation of information by the interviewee. The location and

time, in addition to the requirement of an interpreter and the needs of the interviewee among others, must be considered.

Understanding Maritime Casualty Investigation.

An investigation or inquiry (however referred to by a State) into a maritime casualty or maritime incident that is done to prevent maritime casualties and maritime incidents in the future is referred to as a maritime casualty investigation (HPCG/CG-8/MSSC SOP Nr 04-22, 2022). According to the US Code of Federal Regulations (1974), a marine casualty is defined in Title 46 Code of Federal Regulations (CFR), Part 4.03-1. Essentially, it is casualty or accident involving a vessel (other than a public vessel), that occurs upon the navigable waters of the United States, its territories or possessions. 46 CFR 4.03-1(b) indicates the term "marine casualty" applies to events caused by or involving a vessel, and it goes on to list specific occurrences or incidents that constitute a marine casualty. Some examples include loss of life, collisions, groundings, loss of propulsion, and incidents involving significant harm to the environment. As part of the inquiry, information is gathered and examined, cause variables are determined, and safety recommendations are made as necessary.

Seafarers work under a hostile working environment at sea and no matter how many precautions are taken, accidents are bound to happen to result in injuries ranging from minor to the most gruesome types; some even leading to fatalities (Gorecho, 2019). The frequency and gravity of these accidents are a measure of the competence of maritime managers, both in the government and private sector, in the necessary task of policing and overseeing the industry (Arellano, 2015). The term marine accident refers to the event wherein there is damage to a ship or facilities other than a ship, related to the ship operation, or causing death or injury to people concerned with the construction, equipment, or operation of a ship. Furthermore, a marine incident refers to a situation wherein the ship experiences loss of control due to navigational equipment failure, the listing of the ship, and shorts in the element system for engine operation (Bowo et al., 2017).

PCG as a Coastal State Authority. The Philippine Coast Guard (PCG), as a coastal State authority, is mandated to enforce regulations in accordance with all relevant maritime international conventions, treaties or instruments and national laws for the promotion of safety of life and property at sea within jurisdiction of the Philippines, enforce flag and port State control inspection and salvage operations, maritime casualty investigation, to enforce laws, promulgate and administer rules and regulations for the protection of marine environment and resources from offshore sources or pollution within the maritime jurisdiction of the Philippines and perform other functions as may be necessary in the fulfillment of its mandate (DOTC, 2015). One of the functions of the PCG is the conduct of maritime casualty investigation. This function is primarily done by the MSSC through its functional service, the Maritime Casualty Investigation Service (MCIS). An investigation conducted by the maritime casualty investigators of the MSSC will be used to enhance a better understanding of maritime casualty investigation and therefore, the PCG's Official Maritime Casualty Investigation will be used for this purpose. The conduct of maritime casualty investigation shall conform to international standards as recommended by the "Code of the International Standards and Recommended Practices for Safety Investigations into a Marine Casualty or Marine Incident" of the International Maritime Organization (RA 9993; IRR, 2009).

The safety recommendations focused on developing the company's safety policies and enhancing the maintenance policy and strict adherence to the PCG's Circular and other relevant maritime safety policies.

Conduct of Maritime Casualty Investigation. Causes of any ship collision may include blatant human error, be it an error in judgment or navigation or both, and any technical malfunction or mechanical failure of the system or machinery (Gorecho, 2021). To identify the ideal way to prevent ship accidents from happening in the future, it is essential to understand the factors that can lead to ship

accidents. When all types of incidents were combined, "inadequate risk management" was most frequently cited as both a direct cause of the accident and a contributory factor (Acejo, et al., 2018). To determine appropriate preventive measures, a holistic and systematic approach to safety is required. In intricate socio-technical systems like maritime transportation, every component has the potential to contribute to errors and mishaps. As a result, it is critical to examine all human chain errors, not just those involving seafarers. Other tiers, including shipbuilding firms, ship-owning firms, classification organizations, business associations, and governmental regulatory authorities, also make decisions that are crucial for safety. Marine safety investigation is a specialized task, which should, ideally, only be undertaken by suitably qualified investigators consistent with the CI Code, Ch.15 and IMO Resolution A.1054 (27) Annex Pt. 2, paragraphs 15, 16, 23, and 38 to 41 inclusive. However, some States will not have personnel dedicated solely to marine safety investigation. In these States, it may be appropriate that suitable personnel should be identified and trained in marine safety investigation techniques before being assigned to marine safety investigation duties. When assigned to a marine safety investigation, such personnel should be relieved of their regular duties and, in the context of the investigation, be free from external direction (CI Code, Ch.11). However, they must not investigate where they may have a conflict of interest. Studies are being conducted to reduce the probability of human error in the marine industry. In recent years, international organizations that engaged in maritime activities, particularly authorities, such as the International Maritime Organization (IMO), the International Labour Organization, and International Association of Classification Societies (IACS), have shown greater concerns regarding human error (Akyuz et al., 2016)."

METHODOLOGY

Research Design. This study employed a descriptive correlation design. Descriptive correlation is used in research studies that aim to provide static pictures of situations as well as establish the relationship between different

variables. Hence, descriptive correlation was the appropriate design for the study as it yielded the relationship result between the current qualification and competency of the maritime casualty investigators of MSSC as to their performance in maritime casualty investigation. The study design has enabled the researcher to determine the changes that need to be done in order to enhance the performance of the maritime casualty investigators.

Population, Sample Size, and Sampling Technique. The respondents of the study were 57 maritime casualty investigators who have undergone a 10-day training on maritime casualty investigation. These maritime casualty investigators were assigned to different Maritime Safety Services Units (MSSU's) and Coast Guard Districts all over the Philippines. Since the researcher has direct contact with the respondents, it was easy to send the set of questionnaires via google sheets.

Research Instrument. The researcher created a questionnaire to collect the study's data. Specific information was elicited by the questionnaire to meet the study's objectives. The questionnaire consists of three main sections. The first section determined the educational background of the respondents. The second section measured the technical knowledge of the maritime casualty investigators while the third part was the self-assessment of the maritime casualty investigators in their competence. To ensure the validity of the instrument, the validation process was done by employing three experts – a maritime casualty investigator, a language specialist, and a statistician. On the other hand, to determine the reliability of the instrument, a reliability test was done through a test run of 15 maritime casualty investigators who were asked to answer the final draft of the questionnaire. For ethical reasons, the 15 who underwent the test run were no longer included in the survey proper. Employing a Statistical Package for Social Sciences (SPSS) to compute the data, the instrument yielded a 0.94 Cronbach Alpha indicating that the instrument is very reliable.

Data Gathering Procedure. The survey proper was done on March 2023 to April 2023. The researcher gathered data by sending the questionnaire to the maritime casualty investigators via Google sheet questionnaire to measure their competence and qualification. Through this, the respondents had conveniently answered the instrument within their assigned quarters at the Maritime Safety Services Units and in different Coast Guard Districts. For ethical consideration, the researcher initially asked consent from the respondents if they can participate in the survey by sending them a letter and attesting to their approval to participate in the survey. Utmost confidentiality was ensured throughout the conduct of the study to protect the sanctity of the gathered data. In addition, the researcher was also guided by the "AIMS Research Ethics Policies of 2021" in gathering the data.

Statistical Treatment of Data. The data gathered were consolidated and tabulated accordingly. Further, data were subjected to statistical treatment using SPSS to aid the proponent in answering the problems reflected in the study. Hence, frequency count and percentage, weighted mean, and Pearson r were the statistical tools used to elucidate the data of the study.

Frequency count and percentage were used to determine the number of the current maritime casualty investigators of MSSC as to their level of education, field of education, and related trainings in maritime casualty investigation. This is reflected in objective 1 of this study – the qualification of the present maritime casualty investigators of the maritime safety services command.

Weighted mean was used to test the performance of maritime casualty investigators in terms of their technical knowledge in maritime casualty investigation. This is reflected in objective 2 of this study – the performance of the present maritime casualty investigators in the general investigation technique test.

Weighted mean was also used to determine the investigative competency of the maritime casualty investigators through their self-assessment test. This is reflected in objective 3 of this study – the maritime casualty investigators assess their investigative competency.

Lastly, Pearson r was used to test if there exists a significant relationship between the following variables: between qualification and general investigation technique; and, between qualification and investigative competency. This is specifically presented in objective 4 of the study.

RESULTS AND DISCUSSION

As reflected in Table 1, majority of the maritime casualty investigators are bachelor's degree holders with 71% (41 out of 57) while 21% (12 out of 57) are vocational/associate degree holders. A meager 7% (4 out of 57) are master's degree holders. Further, data showed that, among the seven fields of education included in the study, most of the present maritime casualty investigators came from the disciplines of social sciences (31%) and technology (19%).

Table 1
Qualification of the present maritime casualty investigators of the maritime safety services command

	<i>n</i>	<i>%</i>
Level of Education		
College Level	41	71.92
Master's Level	4	7.03
Associate/Vocational Level	12	21.05
Field of Education		
Seafarers	7	12.28
Marine Engineers	5	8.77
Technology	11	19.30
Social Sciences	18	31.57
Applied Sciences	3	5.26
Natural Science and Mathematics	8	14.05
Management Science	5	8.77
Related Trainings		
MCI Training	33	57.89
VSEI/ERE	11	19.30
PSC	9	15.78
None	4	7.03

Some connections between social science and marine casualty investigation can be seen in the

works of Reason Guldenmund (2000), Helmreich et al. (1999), Hailemariam and Paulsson (2004), and Slovic (2000). It can therefore be deduced that the above disciplines contributed in understanding human factors that analyze the actions and decisions of individuals involved in accidents, including crew members, operators, and other stakeholders. Social science can provide insights into factors such as human error, communication breakdowns, organizational culture, and crew interactions, which may have contributed to the accident. Social science can help identify factors that contribute to a positive safety culture, such as effective communication, leadership, training, and accountability.

By examining the organizational dynamics and safety culture, maritime casualty investigators can better understand how these factors might have influenced the accident and make recommendations for improvement. Additionally, social science disciplines, including law and political science, can provide insights into the regulatory frameworks and legal aspects that govern maritime operations and accident investigations. Understanding the legal context is essential for maritime casualty investigators to assess compliance with regulations, identify any potential legal issues, and make recommendations for regulatory improvements if necessary. While the field of maritime casualty investigation primarily focuses on determining the causes of accidents and ensuring maritime safety, technology plays a crucial role in various aspects of this field such as technical expertise, data analysis and forensics, cybersecurity, safety systems, and risk management. Professionals with technology-related degrees can contribute their technical expertise to analyze the technical aspects of accidents, assess equipment failures, evaluate maintenance practices, and determine the role of technology in the accident sequence.

Table 2 presents the performance of the maritime casualty investigators through assessment using 9 criteria. These criteria are ethics, attention to detail, control, critical thinking, curiosity, interviewing, research,

surveillance, and writing. Based on the results, the maritime casualty investigators have the following performances in 9 criteria: ethics (average), attention to details (higher), control (low), critical thinking (low to average), curiosity (higher), interviewing (very low), research (higher), surveillance (more than half of the respondents has higher performance) and writing (50% - 50% performs higher and lower). The overall mean score of 21.01 out of the total score of 35 suggests that the present maritime casualty investigators perform on average in the general investigation technique test.

Table 2
Performance of the present maritime casualty investigators in the general investigation technique test

Criteria	Scores (Minimum to Maximum)	Frequency	Percent (%)	Mean	Standard Deviation
Ethics	0	14	24.56	1.00	0.70
	1	29	50.88		
	2	14	24.56		
Attention to Detail	1	2	3.52	2.43	0.56
	2	28	49.12		
	3	27	47.36		
Control	0	1	1.75	2.78	1.09
	1	7	12.28		
	2	12	21.05		
	3	22	38.59		
	4	13	22.8		
Critical Thinking	5	2	3.52	5.14	1.48
	2	1	1.75		
	3	8	14.03		
	4	9	15.78		
	5	17	29.82		
	6	12	21.05		
	7	7	12.28		
	8	2	3.52		
	9	1	1.75		
Curiosity	2	3	5.26	4.89	1.34
	3	5	8.77		
	4	16	28.07		
	5	9	15.78		
	6	19	33.33		
	7	5	8.77		
Interviewing	0	53	92.98	0.07	0.25
	1	4	7.02		
Research	1	8	14.03	2.54	0.86
	2	16	28.07		
	3	27	47.36		
	4	6	10.52		
Surveillance	0	24	42.10	0.57	0.49
	1	33	57.89		
Writing	0	7	12.28	1.56	0.94
	1	22	38.59		
	2	17	29.82		
	3	11	19.29		
Overall mean score and standard deviation				21.01	3.88

Table 3 presents the investigative competence of the maritime casualty investigators (MCIs). The MCIs demonstrated a consistent application of safe work practices, including adept employment of proper lifting techniques and adherence to personal protective equipment (PPE) guidelines. 4.09, showcasing their commitment to maintaining a safe work

environment. Additionally, the present MCI exhibits an average to higher level of competence in identifying potential hazards within investigation sites. With a mean level of 3.81, their ability to recognize and assess potential risks underscores their attentiveness to ensuring the safety of themselves and their colleagues during investigative procedures.

Moreover, the MCI displays an average to higher proficiency in locating emergency equipment and evacuation routes onboard vessels. This vital skill is reflected in a mean level of 3.86, emphasizing their capability to respond to critical situations and ensure the well-being of all personnel swiftly and effectively. Nevertheless, the data analysis indicates that while certain items within the investigative criteria remain undecided, the current MCI possesses commendable levels of competence in crucial aspects of personal safety, hazard identification, and emergency preparedness. These findings highlight the team's dedication to maintaining safety standards, mitigating risks, and fostering a secure and collaborative investigative environment. The current team of Maritime Casualty Investigators (MCI) demonstrates a commendable level of competence in several key areas. Firstly, their consistent display of respect towards all co-workers and team members is evident, with an impressive mean level of 4.15. This indicates a high standard of interpersonal interactions within the team.

Furthermore, the MCI members exhibit a proactive approach to collaboration and teamwork. They actively take initiatives to assist others, mitigate potential team-related issues, and contribute to overall team success. Participation in workgroup meetings is another notable strength of the present MCI. Their positive and helpful contributions in these meetings significantly contribute to effective group dynamics. This skill is highlighted by their mean level of 4.12, showcasing their ability to engage constructively in team discussions.

Table 3
Mean Distribution on the Investigative Competence of the Maritime Casualty Investigators

Criteria	Mean	Standard Deviation	Interpretation
Personal Safety and Knowledge of Safety Practices			
I consistently use safe work practices, such as lifting techniques and PPE.	4.09	0.66	Agree
I can identify the potential hazards that exist in investigation sites.	3.81	0.69	Approaching Agree
I can locate the emergency equipment and evacuation routes onboard a vessel.	3.86	0.69	Approaching Agree
I have a working knowledge of key legislation in relation to maritime casualty investigations.	3.30	0.70	Undecided
I can help MCIT complete key safety documentation, such risk assessment.	3.67	0.69	Undecided
I can show how safety performance is measured.	3.79	0.67	Undecided
I can explain the different steps of the organization's investigation process.	3.47	0.76	Undecided
Average Weighted Mean:	3.71	0.47	Undecided
Evidence Collection			
I can define the key document types that should be collected as part of an investigation.	3.78	0.67	Undecided
I can show how to effectively photograph and document evidence at the scene.	3.75	0.68	Undecided
I can demonstrate the effective use of interview questions with different witness types.	3.56	0.70	Undecided
I can define the types of evidence needed for effective root cause analysis use.	3.59	0.67	Undecided
I can describe the process used to help facilitate rapid and thorough evidence capture.	3.53	0.71	Undecided
Average Weighted Mean:	3.64	0.62	Undecided
Snapchart Construction			
Demonstrates the ability to build an incident timeline with sufficient details.	3.53	0.68	Undecided
I can effectively use dates and times on events to help ensure timeline accuracy.	3.79	0.70	Undecided
I can properly define causal factors across the timeline.	3.54	0.67	Undecided
I can effectively assemble a wide complement of evidence under each causal factor.	3.44	0.71	Undecided
Average Weighted Mean:	3.57	0.62	Undecided
Root Cause Analysis			
I can effectively use evidence to answer root cause dictionary questions.	3.56	0.65	Undecided
I can explain how the root cause flows from the top of the tree to root causes.	3.45	0.65	Undecided
I listen to the thoughts of others when working through the root cause tree with a group.	3.54	0.68	Undecided
I use notes to help clarify the intent or a question or set of questions.	3.78	0.62	Undecided
Average Weighted Mean:	3.58	0.49	Undecided

Corrective Action Development			
Writes recommendations that clearly define how the desired change will be implemented.	3.73	0.61	Undecided
I can write actions to address both short (correction) and long term (prevention) needs.	3.54	0.59	Undecided
I focus on minimizing the potential for root cause and causal factor recurrence.	3.59	0.62	Undecided
Average Weighted Mean:	3.62	0.51	Undecided
Attitude and Teamwork			
I can effectively lead groups through all key steps of the investigation process.	3.56	0.70	Undecided
I consistently show respect for all co-workers and team members.	4.15	0.70	Agree
I take the initiative to help others, avoid team problems, and promote team success.	4.00	0.65	Agree
I participate in workgroup meetings in a positive, helpful manner.	4.12	0.68	Agree
Average Weighted Mean:	3.96	0.59	Agree
Composite Mean:	3.68	0.54	Undecided

Among the various investigative competencies evaluated, the 'attitude and teamwork' criteria stand as the highest mean level with 3.96. This demonstrates that the current MCI possesses an above-average to high level of attitude and teamwork. This criterion's exceptional mean level underscores the team's capacity to work cohesively and maintain a positive outlook while handling investigative tasks.

When assessing the investigative competencies, it is observed that safety-related skills and practices, evidence collection, snapchart construction, root cause analysis, and corrective action development all fall within an average range. Hence, the current MCI exhibit commendable levels of respect, teamwork, and active participation, while also showcasing competence in various investigative aspects. The standout performance in 'attitude and teamwork' further emphasizes their cohesive and positive approach to their work. The team's overall competence is evidenced by their consistently solid mean levels across the evaluated criteria.

Table 4 presents the correlation result between the qualification of maritime casualty

investigators and the general investigation technique test. Results have shown that there is no significant relationship between the qualifications of the respondents and highest educational attainment ($r_s = 0.054$), area of specialization ($r_{xy} \chi^2 = 116.481$), and trainings attended relevant to maritime casualty investigation ($r_{xy} = 0.067$).

Table 4
Correlation between Qualification of Maritime Casualty Investigators and General Investigation Technique

Variables	Correlation Coefficient	p-value	Decision
Level of education	$r_s = 0.054$	.346	Accept H_0
Field of education	$r_{xy} \chi^2 = 116.481$	.076	Accept H_0
Trainings attended relevant to maritime casualty investigation	$r_{xy} = 0.067$	.310	Accept H_0

This is because the computed values of the correlation coefficient in each variable are significant at a level higher than the margin of error $\alpha = 0.05$. Hence, the relationship between the correlated variables is not significant. Regarding the positive values of the correlation coefficients, change in the independent variable will cause the dependent variable to change in the same direction since the relationship is directly proportional.

Since no significant relationship between highest educational attainment and general investigation technique test ($r_s = 0.054$, $p > .05$), area of specialization and general investigation technique test ($r_{xy} \chi^2 = 116.481$, $p > .05$), and trainings attended relevant to maritime casualty investigation and investigation technique test ($r_{xy} = 0.067$, $p > .05$), null hypotheses are accepted. Hence, relationships between the correlated variables are of no significance.

On the other hand, Table 5 reveals the correlation between qualification of maritime casualty investigators and investigative competency self-assessment. Analysis has shown that there is no significant relationship between the level of education of the present maritime casualty investigators and the 6 investigative competencies. These results suggest that level of education alone may not

be a reliable predictor of proficiency in the assessed competencies, warranting further exploration of additional factors that may contribute to the development of marine investigative skills. Qualifications like education level, training attended, and previous specialization area do not significantly correlate with the performance attributes of maritime casualty investigators. While these qualifications may demonstrate theoretical knowledge and expertise in specific areas, they fall short in assessing essential qualities for investigative success.

Table 5
Correlation between Qualification of Maritime Casualty Investigators and Investigative Competency Self-assessment

Variables	Correlation Coefficient	p-value	Decision
FIELD OF SPECIALIZATION OF PREVIOUS WORK ($r_{xy} \chi^2$)			
Personal safety and knowledge of safety practices	124.609	<.001	Reject H_0
Root cause analysis	63.712	0.017	Reject H_0
RELATED TRAININGS (r_{xy})			
Personal safety and knowledge of safety practices	0.242*	0.035	Reject H_0

For instance, ethics, attention to detail, control, critical thinking, curiosity, interviewing skills, research abilities, surveillance techniques, and writing proficiency are crucial for effective investigations but are developed through experience and individual attributes rather than formal qualifications. The chi-square test ($\chi^2 = 124.609$) reveals a highly significant relationship between the area of specialization and personal safety and knowledge of safety practices ($p < .001$). This indicates that the area of specialization is significantly associated with differences in personal safety competencies among the present maritime casualty investigators. Also, the chi-square test ($\chi^2 = 63.712$) reveals a significant relationship between the area of specialization and root cause analysis ($p = 0.017$). This suggests that specific areas of specialization significantly contribute to differences in root cause analysis competencies among the present maritime casualty investigators.

However, no significant relationships were observed for evidence collection ($\chi^2 = 81.036$, $p = 0.218$), snapchart construction ($\chi^2 = 67.407$, $p = 0.104$), corrective action development ($\chi^2 = 48.023$, $p = 0.087$), and attitude and teamwork ($\chi^2 = 50.191$, $p = 0.387$) competencies, indicating that the area of specialization does not significantly impact individuals' competencies in these areas. According to Pohling et al. (2016), ethical behavior is influenced by personal values and decision-making skills rather than qualifications alone. Wettstein et al. (2011) argue that attributes like critical thinking and curiosity are not necessarily tied to educational qualifications but are essential for problem-solving and analysis. Similarly, practical skills in interviewing, research, surveillance, and writing are honed through practical application and on-the-job experience. Therefore, while qualifications provide a foundation of knowledge, they do not adequately reflect or predict the performance attributes required for successful maritime casualty investigations.

The Pearson correlation analysis was conducted to examine the relationship between the type of training attended relevant to maritime casualty investigation and marine investigative competencies. Results indicate that there is no significant correlation between the type of training attended and marine investigative competencies. However, a significant relationship was observed in the competency of personal safety and knowledge of safety practices ($r_{xy} = 0.242$, $p = 0.035$), indicating that the type of trainings attended relevant to maritime casualty investigation is associated with differences in personal safety competencies.

Conversely, no significant correlations were found for the remaining competencies: evidence collection ($r_{xy} = 0.173$, $p = 0.100$), snapchart construction ($r_{xy} = 0.153$, $p = 0.128$), root cause analysis ($r_{xy} = 0.043$, $p = 0.376$), corrective action development ($r_{xy} = 0.043$, $p = 0.499$), and attitude and teamwork ($r_{xy} = 0.164$, $p = 0.111$). These findings suggest that while the type of trainings attended relevant to maritime casualty investigation may play a role in enhancing personal safety and knowledge of safety practices, it does not have a significant

influence on the overall competencies assessed. Similarly, qualifications of the present maritime casualty investigators such as educational attainment, trainings attended, and previous area of specialization do not significantly correlate with the investigative competencies of maritime casualty investigators. While these qualifications may provide a foundation of knowledge, they fail to capture the practical skills and attributes necessary for effective investigations.

Investigative competencies, including personal safety and knowledge of safety practices, evidence collection, snapchart construction, root cause analysis, corrective action development, and attitude & teamwork, are developed through experience, on-the-job training, and industry-specific expertise. Personal safety and knowledge of safety practices, for instance, require ongoing training and familiarity with industry standards (International Maritime Organization, 2008).

Likewise, proficiency in evidence collection techniques, snapchart construction, root cause analysis, and corrective action development relies on practical application and exposure to diverse investigative scenarios (Rothblum et al., 2002). Additionally, effective collaboration and a positive attitude, crucial for teamwork in investigations, are shaped by an investigator's interpersonal skills and emotional intelligence, which are not solely determined by qualifications. Therefore, while qualifications may indicate theoretical knowledge, they do not significantly correlate with the practical competencies required for successful maritime casualty investigations.

The research findings underline a crucial aspect in the realm of maritime casualty investigation: the conventional benchmarks of qualifications, encompassing factors like one's level of education, participation in relevant training programs, and the specialized domain of prior work experience, do not exhibit a noteworthy correlation with the diverse range of skills and competencies demonstrated by present-day maritime casualty investigators. Although these qualifications can furnish a basic framework of

theoretical knowledge, they prove insufficient in encapsulating the core attributes and pragmatic proficiencies imperative for conducting investigations with efficacy and finesse.

While qualifications can lay down a solid academic foundation, they fail to encompass the multifaceted traits and hands-on skills that form the bedrock of effective investigative work. Traits such as an unwavering commitment to ethical standards, a meticulous attention to even the minutest details, the ability to engage in critical thinking to unravel complex scenarios, an innate curiosity that drives thorough exploration, and practical aptitudes encompassing adeptness in interview techniques, adeptness in research methodologies, mastery in surveillance strategies, and adeptness in crafting comprehensive and coherent written reports, are not effectively captured by formal qualifications alone.

Furthermore, a holistic set of competencies that include ensuring personal safety during investigations, the proper collection and preservation of evidence, the construction of visually informative tools like snapcharts to depict intricate details, delving into root cause analysis to unearth underlying factors, formulating strategies for corrective actions, and exhibiting a positive attitude towards teamwork, are attributes that emerge and mature through practical experience, on-the-job learning, and the accumulation of industry-specific insights.

Moreover, to solely rely on qualifications as indicators of investigative success within the maritime sector would be a limited approach, as it fails to accurately gauge an investigator's true abilities and on-ground performance. The intricate blend of ethical principles, a keen eye for detail, analytical acumen, an inquisitive disposition, practical proficiencies, and a well-rounded repertoire of competencies forged through hands-on experience collectively shape an investigator's effectiveness and contribution to the field.

DISCUSSION

The research findings underline a crucial aspect in the realm of maritime casualty investigation: the conventional benchmarks of qualifications, encompassing factors like one's level of education, participation in relevant training programs, and the specialized domain of prior work experience, do not exhibit a noteworthy correlation with the diverse range of skills and competencies demonstrated by present-day maritime casualty investigators. Although these qualifications can furnish a basic framework of theoretical knowledge, they prove insufficient in encapsulating the core attributes and pragmatic proficiencies imperative for conducting investigations with efficacy and finesse.

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Moreover, to solely rely on qualifications as indicators of investigative success within the maritime sector would be a limited approach, as it fails to accurately gauge an investigator's true abilities and on-ground performance. The intricate blend of ethical principles, a keen eye for detail, analytical acumen, an inquisitive disposition, practical proficiencies, and a well-rounded repertoire of competencies forged through hands-on experience collectively shape an investigator's effectiveness and contribution to the field.

Recommendations. To enhance the selection and assessment procedures for maritime casualty investigators, the following recommendations are proposed:

Firstly, establishing clear and unambiguous job prerequisites is fundamental to refining the selection and evaluation process for maritime casualty investigators. This involves precisely defining the necessary qualifications, skills, and experiential background essential for prospective investigators. Detailed job descriptions should be crafted, outlining the crucial competencies required. These competencies should encompass not only a deep understanding of maritime regulations but also a demonstrated expertise in investigation methodologies and the ability to perform effectively under high-pressure circumstances.

Secondly, implementing a robust screening process is imperative to determine the suitability of potential candidates. This process should entail a thorough assessment, encompassing meticulous resume reviews, structured interview sessions designed to assess candidates' capabilities, and potentially including written assessments to evaluate their knowledge and skill levels. To ensure fairness and objectivity, a systematic scoring system or well-defined criteria checklist should be employed. Integrating a Quality Management System (QMS) within the Maritime Safety Services Command could be an effective means of achieving this.

Thirdly, offering specialized training and certification programs tailored exclusively to

maritime casualty investigators is essential. These programs should be meticulously designed to not only refine investigative skills but also broaden their knowledge base. Training topics should encompass diverse subjects such as incident analysis methodologies, innovative evidence collection techniques, advanced interviewing methods, and the art of creating comprehensive investigative reports.

Additionally, valuing practical experience, particularly from candidates with hands-on maritime industry backgrounds, is crucial. Candidates with prior experience, such as former seafarers, bring invaluable familiarity with the sector. Practical experience equips investigators with profound insights into the complexities and challenges intrinsic to real-world investigative scenarios, enhancing their efficacy. Continuously evaluating investigators' performance and evolution is essential. This requires a multifaceted approach, incorporating performance evaluations, peer assessments, and feedback from stakeholders.

Regularly revisiting and refining evaluation criteria ensures alignment with evolving industry standards and best practices. Also, providing ample learning and development opportunities is vital to nurture a culture of professional growth. This involves organizing workshops, seminars, conferences, and involving investigators in simulation exercises.

Encouraging investigators to stay updated on industry trends and fostering an environment of continuous learning is pivotal.

Incorporating a structured feedback mechanism, allowing stakeholders like clients, regulatory bodies, and industry experts to provide insights on investigator performance, is integral. This feedback offers valuable perspectives for identifying areas that require improvement and refining the investigation process for greater effectiveness.

Furthermore, fostering a collaborative learning culture within investigative teams is paramount. Encouraging investigators to engage in continuous learning initiatives,

participate in professional forums, and facilitate the exchange of experiences and best practices contributes to their professional growth and enhances investigative skills. Platforms for analyzing past cases and lessons learned not only cultivate critical thinking but also nurture a culture of continuous improvement.

Lastly, pursuing further education in this domain is strongly advised. By implementing these comprehensive recommendations, organizations can elevate the selection and development processes for maritime casualty investigators. This ensures the appointment of investigators equipped with the essential attributes and competencies needed to conduct effective, meticulous, and comprehensive investigations within the maritime industry.

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