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NSIA method: What are the pillars of the Norwegian accident investigation model?

Método NSIA: ¿Cuáles son los pilares del modelo de investigación de accidentes noruego?

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(interviewee)

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RSO Journal
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Abstract

The RSO Magazine interview team interviewed Jan Thore Mellem, a member of the Advisory Department of the Norwegian Safety Investigation Authority (NSIA) and a specialist in human factors, industrial and organizational psychology. Mellem was one of the co-creators of the investigation model and currently provides support from his department to all areas of the agency.

Resumen

El equipo de entrevistas de la Revista RSO entrevistó a Jan Thore Mellem, integrante del Departamento de Asesoramiento de la Autoridad Noruega de Investigación de Seguridad (NSIA) y especialista en factores humanos, psicología industrial y organizacional. Mellem fue uno de los cocreadores del modelo de investigación y actualmente brinda soporte desde su departamento a todas las áreas del organismo.

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The Advisory Department was tasked with developing the project when NSIA determined the need for its own accident investigation tool. The interviewee notes that Ingvild K. Ytrehus, the NSIA Method's primary proponent and original originator, collaborated closely with Jan Thore Mellem. After this new model was approved, they concentrated on the training and coaching of the agents in addition to creating the groundwork for it.

Could you provides some general considerations to keep in mind when using the NSIA method?
One the one hand, the model is applied to every manner or area of the Agency, including defence. Each candidate interested in working with us should read the comprehensive explanation on our website as a basic introduction to the process. Next, as part of their first assignments —a typical place for any investigator to start— whoever is hired by NSIA will go even farther into the process.

Yet, we would like to point out that a model is always a simplified version of reality; the real world is typically considerably more complex. The world cannot be expected to perfectly match the model. Like any other model, this one can only aid in our comprehension of the intricacies of reality. We usually opt to make a

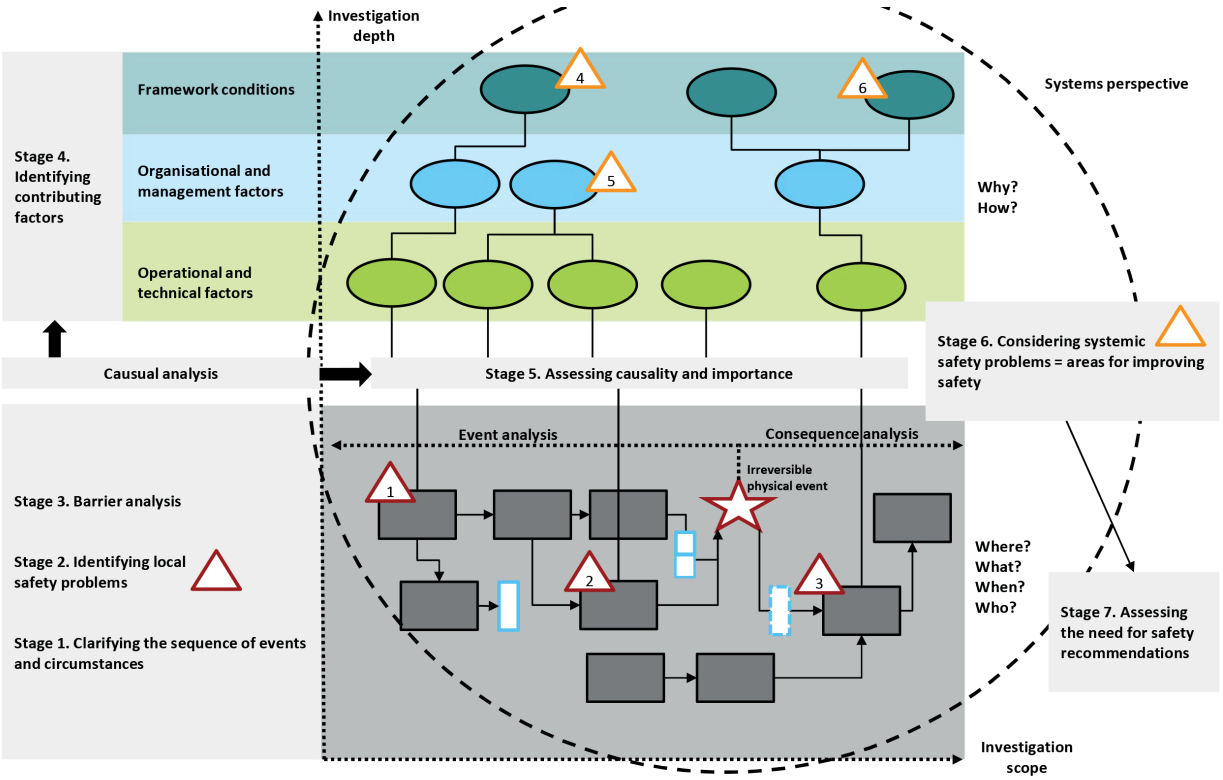
call for attention here even if this may seem evident to some individuals but not to others. Ignoring this aspect could lead investigators to adopt a strong belief in the hypothesis, which is extremely risky.

The visual representations that the model produces have two portions, as may be seen by looking at them. One lower section for the first three stages and a higher one for the final four. Everything that progresses to the fourth level is automatically regarded as systemic. We classify the model as a systemic approach method since it forms a complete circle.

When we teach this methodology, one of the things we always stress is that iteration is a process. That is, it repeatedly travels around the same aspects. It's not a case of doing everything we can in the beginning and then never again; quite the contrary. The circle needs to be repeated numerous times because as the accident is examined and comprehended more fully, new issues come up and fresh data is provided. You might need to revise your hypothesis of what transpired in light of this new information, repeatedly returning to each phase.

"The circle needs to be repeated numerous times because as the accident is examined and comprehended more fully, new issues come up and fresh data is provided.

Figure 1. Visual representation of the seven stages of the model



Source: NSIA document "How we investigate accidents in Norway", 13/09/2022.

Why did you decide to develop your own investigation methodology?
The technique first aids in information prioritization. As you are aware, a lot of different information is gathered during accident investigations from a variety of sources, thus it is crucial to arrange it according to its importance. There might be a lot of material that we find fascinating, but that doesn't necessarily mean it has anything to do with the disaster. Prioritizing is crucial because if you examine unrelated material, you will be squandering time and resources.

Second, models created for understanding accidents can be used in a variety of settings, such as technical or academic research, preventive safety work, power plants, and other high-risk settings. To give our inspectors a step-by-step manual

on how to conduct an accident investigation, we wanted a model created specifically for the purpose.

Last but not least, the NSIA employs investigators and analysts from a wide range of subjects and specialties. Occasionally, this makes it more challenging for people to understand or agree upon one another, primarily due to the absence of common vocabulary. We considered developing a system that could be understood and utilized by everyone, regardless of academic training, field of application within the agency, or level of professional experience, precisely because of this and in order to do our work more effectively. The goal was to create a common language so that communication within the investigator teams and between divisions of our company would be easier. As a result, we would have a similar starting place, a shared vocabulary, and a similar way of thinking.

How did the development of the NSIA Method go?

"Prioritizing is crucial because if you examine unrelated material, you will be squandering time and resources."

The Advisory Staff department in our organization is a group of experts who support every other department. Ingvild K. Ytrehus held a specific position within the Advisory Staff that was devoted to safety approach and technology. She is the method's primary developer and proponent, so it's important that she receives credit. I was there from the beginning when the model was being developed with her as part of the advisory staff, so I can describe how it went.

Ingvild, who held that post for a long time, recognized the need for such investigation instrument. She therefore conducted a thorough assessment of the professional literature on methodology and even got in touch with a number of inquiry boards. It is fair to say that one of the primary references used by NSIA in developing our method was the methodological framework employed by the Australian Transport Safety Board (ATSB). I also want to give them praise for it.

As I previously mentioned, Ingvild prepared the method's initial draft before convening a working group with two or three investigators from each department of the organization. Through numerous sessions, the model was explored and developed. We had a lot of insightful conversations during which different concepts were born. After gathering and processing these comments, Ingvild included them in the method's first complete version, which was published in 2017. The Management has discussed, reviewed, and approved this issue. The technique was subsequently included into our management system.

Also, in 2017 all investigators were trained to use the model. A second edition was published in 2018 and a third edition was then published in 2021 with some minor changes to the approach. It is critical to note that successive editions have refined primarily technical issues, such as the use of colors to visually categorize information, rather than making fundamental changes to the methodology.

In general, this is the tale of how it all started and how it progressed.

How long did it take to really put the Method into practice after it started being developed?

I'm not sure exactly, since it can be challenging to accurately segment procedures over time. But as a generalization, I'd say it took several months. Meetings of the working group and the creation of the final proposal were rushed only in a few months because the method's development was a top priority. And between management's acceptance, the system's implementation, and everyone's training for its use, maybe another six months.

Would you say that the NSIA technique was designed utilizing a consultative manner based on what we have discussed?

Indeed, I do. Naturally, the goal was to catch the attention of investigators and

ensure that they found it useful when implemented for use. In my opinion, that procedure was actually very significant. If this had been forced upon them, I believe the outcome would have been very different.

When was it initially put into practice? Was the process easy or did you encounter any obstacles? What, if any, components of the NSIA technique met with the most resistance when it was first introduced?

It was initially put into use in 2017. The adoption, in my opinion, was gradual. I am unable to cite any instances of active resistance. I believe the gradualness was necessary in order to maximize the model's potential and turn it into a useful tool rather than a burden.

What techniques did the organization employ before the NSIA method was developed?

Actually, no single model was being used consistently at the time. Nonetheless, the writings of authors like Rasmussen, Hollnagel, and Reason undoubtedly had a significant impact on our agency for many years. I'm sure some of that has made its way into our model. Although I believe the model is a significant advancement for us, we still rely heavily on the work of outstanding authors and researchers.

"We considered developing a system that could be understood and utilized by everyone, regardless of academic training, field of application within the agency, or level of professional experience."

Can you briefly describe the NSIA method' and its stages for us?

Of course, the following seven stages make up the NSIA model. Let me go over each step with you.

1. First stage is to clarify the sequence of events and the accident's conditions. This is where we build a step chart. This means creating a systematic way to visualize who did what, what happened, and when, and then translating it into a cartesian coordinates axis. With this model you can see a representation of what led to that irreversible physical event (the accident), and also what happened afterwards. In other words, it is as much about the analysis of the event as it is about its consequences. Questions such as where, what, when and who are predominant at this stage. The participants in the circumstance being analyzed—i.e., any person or thing that has been involved in the accident—are positioned on the vertical axis to create a step chart. On the other hand, the horizontal axis dislpays when each actor performed what, using the information that is now accessible. This provides a clear visual depiction of the case's complexity.

2. The second stage entails identifying local safety issues. The reverse of systemic safety issues are these local safety issues. A local safety issue could be one of three things:

    a. *The barrier approach. When there was a chance that the course of events could have changed or that there might have been interaction.*
    b. *The control approach. When a lack of control or very poor control is involved in the course of events*
    c. *Non-conformity or deviation approach. When a series of events didn't follow a safe or expected pattern.*

As soon as we come across any of these potential circumstances, we flag them as local safety issues, which may be useful to learn what caused the accident. Furthermore, a unique tool is required to be able to record all the information and organize it for particularly complicated or extensive investigations where numerous things occur and a large number of individuals are engaged. You undoubtedly need a tool if, for instance, there are 25 or 35 local safety concerns. Specifically, we have created a chart of safety-related risks for this.

3. The third stage is the analysis of barriers. Three subcategories can also be used to examine barriers in this case:

a. Barriers that were present and effective. Hence, nothing negative occurred there.
b. Existing barriers did not function properly, which allowed the accident to occur.
c. There were barriers that, in our perspective, should have been there but weren't, which led to a safety issue.

4. The identification of the factors influencing each safety issue is the fourth stage. Here, we start with causal analysis by posing the why- and how-questions. We try to comprehend why someone did what they did and why it made sense to them from various points of view, such as the operator's. Investigations into human factors are helpful in this situation.

The elements that might have an impact on safety issues are recorded. Three levels can be used to categorize these factors:

a. Operational and technical aspects
b. Variables at the management or organizational level
c. Contextual conditions

"The writings of authors like Rasmussen, Hollnagel, and Reason undoubtedly had a significant impact on our agency for many years. I'm sure some of that has made its way into our model."

It is convenient to use a real-world example based on an actual event to help clarify this. At one airport, a truck entered what was known as the Papa taxiway after crossing a red line and being in an area that was off-limits to vehicles. For being there, it collided with a plane that was using this Papa taxiway.

The truck driver's inability to hear communications between the control tower and the plane in this case would make it impossible for him to know that the plane would use the Papa taxiway —where the truck was parked in violation of the regulations— would be a technical aspect. Naturally, the truck's drivers anticipated that the plane would use a different runway.

On the other hand, an organizational and managerial component relates to the perception of overwork among drivers at that company due to a perceived staffing shortage. Additionally, they reasoned that since nobody could see them or control them there, they could do whatever they pleased in the vicinity of the Papa taxiway. Since no one intervened to stop the drivers' negligence while jeopardizing safety, this would be an organizational factor.

Finally, a possible factor at the level of contextual conditions may be the fierce competition in the airline business in general. This competition could explain why the company where the truck driver worked was, in the opinion of the drivers, understaffed, perhaps as a measure by the company to lower its costs and thus be more competitive.

Using this classification, it is able to clearly distinguish how the various components are related to one another at different levels and even within each level, which will help us better understand the accident. We should also point out that the three various degrees of investigation pertain to what we typically refer to as the "depth" or "scope" of the investigation. "Depth" refers to how much we investigate organizational and contextual factors (upward in the investigation model). "Scope" refers to how much of the sequence of events we investigate in depth (from left to right in the model). The levels on which we choose to concentrate will then dictate how much of the sequence of events and consequently of the step diagram we will study; meaning, where will we start and where will we finish.

5. Examining importance and causality is the fifth stage. We obtained this information from the ATSB. Let's say we've already found a factor that piques our

Figure 2. Table of safety problems between Boeing aircraft and truck

SAFETY PROBLEMS						
	SAFETY PROBLEM	**FACTUAL INFORMATION (EXISTENCE)**	**INFLUENCE / RELEVANCE**	**WHY?**	**TOPICS TO BE INVESTIGATED**	**Main topics**
1	The driver of the de-icing truck crossed the red safety line without permission from the tower, and parked the truck close to taxiway Papa	The driver acknowledged violating the traffic regulations. CCTV and recordings of tower communications confirm the violation.	If the truck had not violated the traffic regulations, the collision between the Boeing 737-800 and the de-icing truck would not have happened.	Possible explanations for why the safety problem occurred: - The driver was unaware of the traffic regulations - The driver was aware that he violated the regulations, but did it anyway	What do we need to clarify through investigation? - If the driver were unaware of the traffic regulations, had he received adequate training? - If the driver were aware of violating the regulations, for what reason would he do that? What was his situational awareness at the time, leading to this behavior?	Human Factors: training, drifting into failure, situation awareness Infrastructure: Airport design

Source: NSIA´s document, How we investigate accidents in Norway, September 9, 2022.

curiosity. At this point, we pick whether to dig deeper and keep investigating it or, on the contrary, we should discard it. For that, a series of questions should be asked:

- Does this factor really exist? If so, how can its existence be verified or documented? If the response is negative, the specified component is immediately disregarded. We ask the next question if the answer is yes.

- Was there any observable impact of this factor on the course of events? If we must admit that we do not have enough data or that we do not believe that the factor has had an important influence, the answer is no, and so we discard it. But, if we can identify a causal link, we take it into account in our investigation and it will likely be noted in the final report.

- Is this aspect significant? In other cases, we may come across a factor that did not significantly affect the course of the accident or its conclusion, but that we nonetheless feel is essential enough to mention in the final report because of its potential safety implications that go beyond the accident in question. If the response is negative, the factor is categorically eliminated from the analysis. If we answer affirmatively, we include it, but we are very cautious to note that even though it hasn't been proven to have an impact, we still discuss it because it's significant.

6. The sixth step is when systemic safety concerns are taken into account. These are the topics where learning about safety has the most potential. The difficulties we can identify are, like in previous rounds, recorded into a table that describes the problem, the demonstrable facts, what we should look into, etc.

Also, we may utilize the same test with the three questions we asked about the contributing elements in stage five for systemic safety issues (examining causality and importance). This examination frequently assists us in prioritizing the systemic safety issues we will emphasize for correction.

7. The necessity for safety advice is assessed at the seventh step. These suggestions are supported by the data gathered and worked on during the first six phases.

So, those are the seven stages of our model. It should be highlighted how helpful it is, especially when it comes to drafting the final report because it makes the process much simpler.

"We find the model to be a beneficial tool, both in the investigation process and while writing the accident report. As a result, you may break down each factor and bubble into its component parts and explain in plain language how each one affects the other factors and conditions of the event."

Could you provide further details on this final issue regarding the editing?
Naturally, the approach works best when trying to explain what happened and what factors led to the accident. As you are far more likely to be able to explain things in a clear and straightforward manner by following this model, we find the model to be a beneficial tool, both in the investigation process and while writing the accident report. As a result, you may break down each factor and bubble into its component parts and explain in plain language how each one affects the other factors and conditions of the event.

Do you have any further information regarding this model or any other subjects you would like to discuss with us?
I have nothing else to say but thank you, both for the interview and for your interest in our method. It has been a pleasure to share this with you, and connect with other investigation organizations, which is essential for the continual improvement of our everyday practices.