The risk maturity model: a new tool for improved risk management and feedback

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Abstract. Norwegian governmental institutions use their risk management regulations to acquire and manage projects and assess the institutional practices. After many years documenting a positive trend, the audit authority noticed a stagnation in process improvement across the organization. A literature review of the use of risk management maturity models from other industries suggested a method for achieving continuous improvement. A corresponding maturity model has been developed and tested with positive results.

This research developed a risk maturity model based on compliance requirements for the Norwegian defense sector. The intended use of this model is as the foundation for conducting assessments through audits and provide explicit guidance toward given requirements that facilitate extensive improvement in application of the risk management system. Use of the model in performing maturity assessments of organizational elements within the defense sector showed that the model supports the subsequent improvement activities through providing better understanding of the existing situation, and explicit visual feedback on areas that are satisfactory and areas in need of improvement. A maturity model provides a stepwise path showing the next level of improvement on the way to achieve required performance.

Introduction

White paper 17 (Administrasjonsdepartement, 2002-2003) describes the facility of governmental supervision, as part of the institutional management in a new and more complex business environment. The document states the importance of functional and independent audit organizations that are in the position of executive authority within a mandated area. The document further describes the transition from the traditional control regime to internal based control, which also includes the construct called risk management system. As part of the organization's normal business, the risk management system shall support and manage stakeholders, roles, relations, and processes in order to achieve its values and objectives (Public Risk Management Organisation, 2020).

The importance of this change in practice is explained in (Administrasjonsdepartement, 2002-2003, s. 27, author's translation):

It is difficult to find certain types of errors and omissions in a single control. The preventive effect is considered low, because the control only gives feedback from a snap shot in time and does not contribute to a mature understanding, and the audit boards become some kind of a quality assurance, where the audited organization trusts the performed control to disclose the existing errors.

This white paper on the policy of governmental auditing business facilitated the establishment of the Norwegian Armed Forces Material Safety Authority (NAFMSA) (Regjeringen, 2020), with the authority to perform audits in those areas where the civilian authorities are not granted access, within areas of exceptions, or where the defense sector is given extra responsibility to comply with safety regulations.

In 2010 requirements for a systematic process, specified as risk management system (RMS) were formalized through the regulations given in the DKS[1] (Forsvaret, 2010) to comply with increased development and maturity notably within the armed forces. These regulations apply to all departments within the armed forces organization from procurement and project departments to army battalions, airwings and workshops, essentially the complete defense sector. In the period between 2007-2019 NAFMSA conducted more than 200 audits in the defense sector. Audits assess compliance with regulations specifically on material safety and generally on practices indicated by the RMS. There are five risk elements included in the RMS. They are as follows: operational safety, personal safety, security, material safety and environmental protection (Forsvaret, 2010).

Results from audits in the defense sector identified a shortcoming in further organizational development regarding application of the RMS. Historical data from 2007 until today indicated a significant change in the way the organization ensures compliance to risk management, compared to previous practice. At the same time, maturity appeared to stagnate once a group had met the minimum requirements stated in regulations. The audit itself merely identified areas of deviation and the audit team mandate did not provide for further follow up on the matters identifed as needing improvement. Over 50% of these observed areas for improvement are related to the RMS. From a five year period (2015-2019), the research identified 482 observations and of these 299 (62%) related specifically to improvements in the application of the RMS.

Figure 1 illustrates the change of findings for deviations (blue line) and observations (red line) as an average number per audit performed during 2007-2019. This evolution is the result of a sector having adopted the regulations and implemented improvements according to requirements, increased its competency and changed the "way of working" in the organization. As shown, the average number of deviations has decreased from approximatly 8 down to about 2 per audit in this period. At the same time, the observations are more or less at the same level. Deviations are defined as demonstrable violations to requirements and observations are areas of potential improvement, not considered or reported as a violation to a specific requirement. Observations are usually described in audit reports as areas of needed improvements, with a recommendation to take appropriate measures.

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[1] DKS: Direktiv – Krav til sikkerhetsstyring i Forsvaret (Directive – Requirements for risk management system in the Armed Forces)
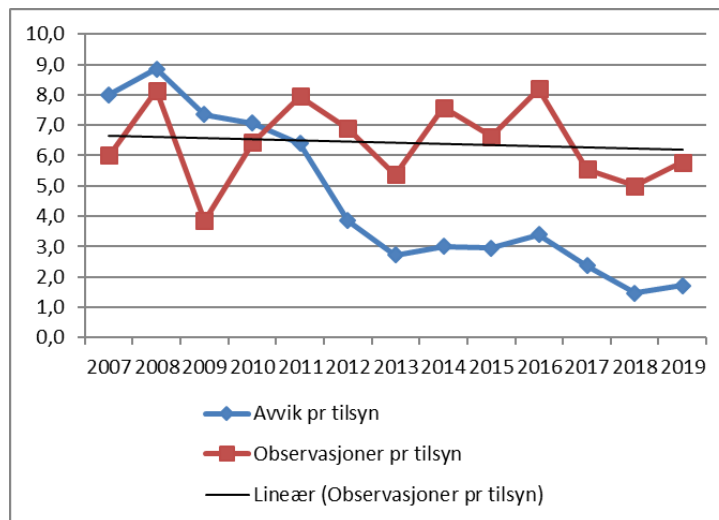
Figure 1: Audit findings, average number of deviations and observations per audit 2007-2019 (Forsvarets materielltilsyn, 2020)

In part, the high-level requirements from DKS leave room for interpretation by each organizational element responsible for their implementation of the RMS. As an example, consider requirement *1.1 "Ensure uniform implementation of continuous improvement"*. The question is how to comply and how to measure compliancy for this requirement? For the department responsible to develop their RMS it is not reasonable to start at that high maturity level. For the audit authority it is not possible to measure the achievement of continuous improvement at this level, and it is not productive to give a violation for non-compliance of such a vague maturity requirement. This would typically be an observation where an audited department is encouraged to improve their effort on the matter of continuous improvements, but without further guides or sub-goals, such observations would probably remain unresolved.

As the sector complies with most of the requirements for RMS, further maturity seems to have stagnated (Forsvarets materielltilsyn, 2019, s. 3). One can infer that the achievement of maturity in the organization stops with those levels of maturity defined in minimum requirements from DKS and other relevant regulations. Also, as Sivertsen and Gunnarshaug (2015) describe in their report, the lack of operationalization of given requirements hamper the implementation of the RMS. With both a variation in interpretation of requirements and a lack of operationalization of the requirements, measures are needed to increase the sector maturity. The only remedies available to the audit board are training and guidance. This highlights a gap in the lack of tools for a systematic approach to provide useful indicators to support these improvements.

Other industries use maturity models to support development and improve their internal practices with good results. The concept of capability maturity models (CMM) has been available for more than 30 years and used extensively in the software industry (Herbsleb et al., 1997). CMM has been applied to industrial process improvment (Doss and Kamery, 2006), quality management (Caballero et al., 2008), construction (Serpell et al. 2014; Wibowo, 2017), and environmental management (Doss et al., 2017). Within the systems engineering community, Yeo and Ren (2009) defined risk maturity models to allow organizations to identify strengths and weaknesses and identify what needed to be done in order to improve and increase their ability to manage risk, complexity and uncertainty. They also found that the risk maturity model could be applied to suppliers and producers

to benchmark their risk management capability against the model. Risk maturity models provide a logical set of benchmarks applicable in assessing the current advancement of risk management practices (Wieczorek-Kosmala, 2014; Bititci, Garengo, Ates, and Nudurupati, 2015).

This research begins with developing a better understanding of how others have benefited from CMM. Then, based on existing requirements and observed shortfalls in the current audit processes, a maturity model is created for use by the NAFMSA auditors. The model is then used for ongoing audits to increase the accuracy of the assessment and improve the feedback to the organizations with guidance that operationalizes those requirements according to defined maturity levels.

This paper seeks to answer the following research questions:

RQ1. How to build a model to assess the risk capability maturity level as part of an auditing process?
RQ2. What factors hamper the development at the departments today, i.e., why is the maturity development so slow?
RQ3. How will such a model potentially influence the level of maturity in the organization?
RQ4. May a risk management maturity model become a useful tool for self-assessments?

Research method

This research applies action research with mixed methods analysis, which combines qualitative and quantitative methods. An overview of mixed research methods displayed for different sequences of the project are seen in figure 2.
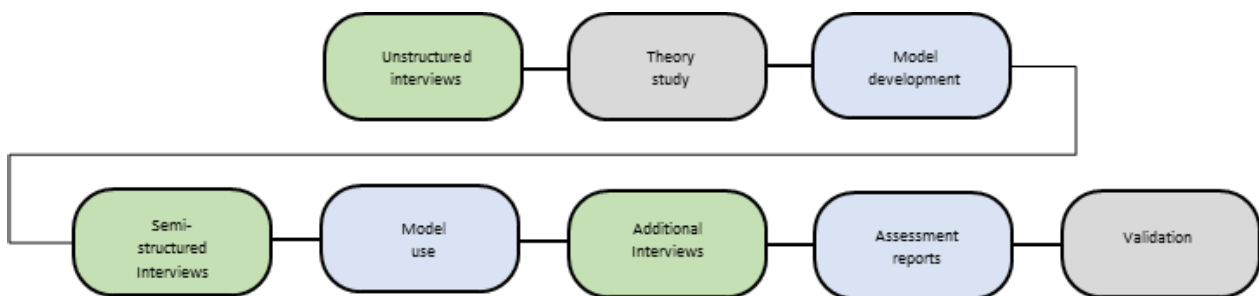

Figure 2: Project sequences overview, blue indicates action research (qualitative method), green indicates interviews (qualitative method) and grey indicates quantitative method

"Action research can be seen as a systematic, reflective study of one's actions, and the effects of these actions, in a workplace, organizational, or community context" (Riel, 2019: 1). Action research creates knowledge in the context of practice (Huang, 2010; O'Brian, 1998). It is differentiated from consulting, or daily problem-solving because the researcher studies the problem systematically and applies relevant theory. In this context, the author is embedded in the auditing organization and as such openly acknowledges potential bias to the other participants while working actively toward resolving a real-world situation. Hahn (2012) concludes that the collaborative relationship between a researcher and participants in action research is helpful in identifying resistance to change, building trust, and designing interventions that will be accepted by the intended audience.

Action research follow an iterative process for developing the model. The PDCA (or Shewart cycle) structures the iterative process of the action research, and has been popularized in the lean development environment (Moen and Norman, 2006; Welo, 2016). Figure 3 illustrates the research path followed throughout.
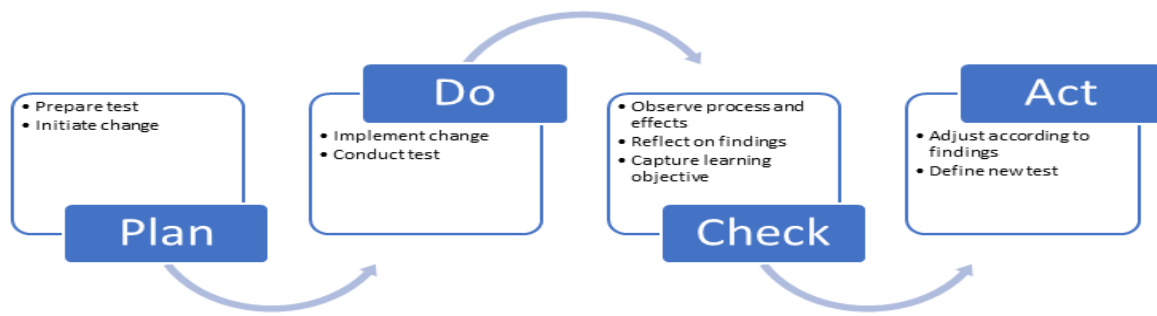
Figure 3: Applied action research process

Action research is an iterative process as described in figure 3. In the planning phase (PLAN), the researcher sets the goal for test sequence and prepare the test set, then documents the process and results using a test sheet to describe the test sequence. The planning phase involves personnel to complete the test and initiate any changes from previous implementation. The test team perform the test as planned for (DO). Findings and learning objectives from the test will be captured and documented in the (CHECK) phase. Participants discuss findings and results and evaluate important learning objectives. During the last phase of the process cycle (ACT), any relevant or important findings are used for adjustments and definition of a potential next test. The process is repeated as necessary.

A fairly comprehensive literature review helped uncover the range of uses of CMM as summarized in the introduction. Articles provided insight into the purpose of these models (Armitage, Brooks, Carlen and Schultz, 2006) and ways to structure a new model to support this research.

Interviews are useful as a method to gather information at different stages of the project. Initially, the researcher conducted unstructured interviews with stakeholders in NAFMSA and employees from audited departments, followed by semi structured interviews with seniors in NAFMSA, with support of a pre-planned interview guide. Additional interviews were performed with a few stakeholders for clarifications and quality check after performing maturity assessments.

A Likert scale survey was used to evaluate a set of claims/statements for a maturity model and its use (Van Peer et al, 2012), as a method to validate the appropriateness of the proposed maturity model and its subsequent implementation. The respondents marked their opinion from a preset scale between Strongly agree, Agree, Neutral, Disagree and Strongly disagree.

Development against a maturity level of an organization must follow a long-term evolution path. During the short span of this project, an evolution or a change in practices will certainly not happen. Duration and scope of this project is limited to include the development and the initial use of a risk management maturity model, a proof-of-concept of the potential value of this approach. In the months and years that follow others will evaluate the potential of its continued use, both to improve the risk management and the feedback given as part of the assessment from audits.

Maturity models in the literature

In general, models support better understanding of the world around us. Systems engineering approaches describe models that help to define, design, analyze, and document the system under de-

velopment (INCOSE, 2015). Maturity models serve the purpose to describe development of an entity over time (Dennis Ahern, 2008). A widely known and early example of a maturity model is Maslow's model of human needs from 1943 (Mørch, 2019), which shows the maturity evolution typified by successfully satisfying one level of needs, before achieving next level. Development of the INCOSE Systems Engineering Capability Assessment Model (SECAM) was first presented in 1995, motivated by the belief that the quality of a product is a direct function of the capabilities of the processes, technology and the people involved (SEI, 1995). From this capability model and other capability maturity models (CMM for software, INCOSE SECAM), the Software Engineering Institute (SEI) launched the Capability Maturity Model Integrated (CMMI) (SEI, 2010). Many different maturity models followed and today a wide range of maturity models have been proposed within many different domains and business segments, such as the System Security Capability Assessment Model, adapted for the system security domain (Simpson and Endicott‑Popovsky, 2010).

A maturity model supports the assessment to find the existing level of maturity in an organization. A model could be an effective tool to identify and structure areas of improvement. A model can further support development of an outlined action plan for the improvement efforts (Hillson, 1997). Within the process-oriented mindset of today, a model to visualize maturity measures can support the risk management process and communicate the steps towards improved maturity. A relevant model contributes in different ways in order to concretize needed measures and make sure the steps and the pace of maturity development are reasonable and verifiable (Williams, 2008). The model could then be a usable tool for the organization to benchmark its maturity within risk management. Even if many maturity models follow the concept where it is mandatory to reach one level of maturity before the next level, there are examples of alternative models. The simple maturity model concept of Nordal and Kjørstad (2017) is an interesting maturity model framework. In this concept, the maturity is assessed based on the total number of approved requirements within each evaluation area and does not follow the commonly used evolution path.

A risk management maturity model could achieve results for improved organizational performance and the risk maturity model is a tool designed to assess risk management capability (Hopkinson, 2016). The use of a risk management model could increase the understanding between the "now-situation" and "desired-situation".

Hillson pointed out; despite the existing consensus on the value of risk management, the implementations are not found effective (Hillson, 1997). Many organizations give up the attempt, or the effort fails to produce the desired results. Becker et al. (2009) described requirements for the development of maturity models with a framework to methodically develop and design maturity models, which were followed in this research and model development.

Identified theory on maturity models does not often dicuss the use of models for communication, but models help visualization that enhances communication (Badrinath, Chang, and Hsieh, 2016; Maier, Eckert, and Clarkson, 2006). Within the systems engineeering community, communication with the use of models that support Model-based Systems Engineering are becoming increasingly widespread (Estefan, 2007). A maturity model may improve the communication and facilitate the feedback in a new format. Figure 4 illustrates the concept of an existing feedback format, describing improvement issues using prose. In the lower part of the figure, an alternative feedback format with support from a model. The goal is to have a simple, visual and concretized feedback, as guidance for audited organizations.
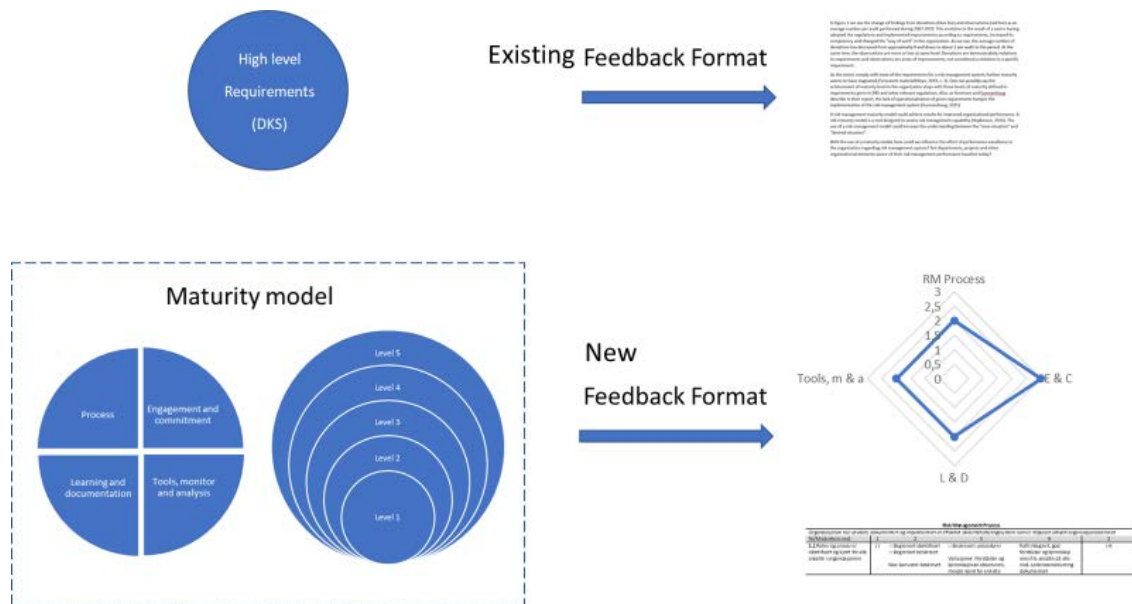
Figure 4. Illustration of ways a maturity model facilitates communication

Model development

Becker et al. (2009) recommend starting with an analysis to find the need for a development of a new model. As so many maturity models already exist, perhaps one can fill the requirement, or maybe just implement a minor change or modification to fit your own need. In this project it was most desirable to use the requirements from government-imposed regulations, and the content of the model needed to reflect these requirements.

Based on current theory in the field, the work began with constructing the overarching model definition. This formed the basis of the model prior to integrating requirements from DKS into the model, and then following the iterative process described in figure 3. Since it was desirable to test the applicability for self-assessments, the model needed to be easy to read and understand for all stakeholders, not only regular users from audit teams. Each maturity level must describe the ambition and give a clear insight of expected level of maturity by its designation.

As a starting point, the last version of the CMMI framework defined five levels of increasing capability and maturity named Initial, Repeatable, Defined, Managed, Optimized, corresponding to levels 1-5 (SEI, 2010). Hillson (1997) defined four levels, respectively named from 1-4; Naive, Novice, Normalized and Natural. For both models, a description of maturity levels provides more information beyond naming the level differently. Using the definition of each maturity level as a starting point, it was possible to choose terminology to explain the ambition each maturity level represents. Both the number of levels and the level description were compared to other known models. Table 1 summarizes the comparison with two well-known and referenced maturity models alongside the definitions created for the purposes of this research.

Table 1: Comparison of maturity levels

	Level 1	Level 2	Level 3	Level 4	Level 5
Hillson	Unaware of the need for RM. No structured approach. Reactive with little or no attempt to learn.	Experimenting with RM application. Including only parts of the organization. No formal or structured process in place.	RM built into business processes. Formalized and widespread. Benefits are understood at all levels. May not be consistency at all levels.	Risk-aware culture with proactive approach to RM. Risk information is actively used to improve processes and gain advantages.	
CMMI	Ad-hoc and chaotic process approach. No stable process environment. Depend on competence of key personnel in the organization.	Planned process to some degree. Reactive processes.	Processes well characterized and understood, described in procedures, tools and standards. Processes are managed and more proactive.	Quantitative objectives established as managing criteria. Relationships exist between subprocesses.	Continually improve its processes. Use of quantitative approach for understanding and process improvements. Continually revised to reflect changes. Analysis to drive the organization.
Our model	Reaction by event. Non-existing documentation, no system or formal approach to Risk Management.	Fragmented RM, limited consistency in existing documentation and procedures.	RM system established and documented. System knowledge and compliancy.	Proactive risk approach. Event handling and analysis. Top management engagement. Communication and documentation.	RM and improvement effort are integrated part of the business. The culture reflects a collective risk awareness and responsibility

As indicated, the new model uses five levels of maturity and the levels from 1-5 describe the respecitve ambition for each level with the intention that they should be recognized and easily communicated. The 5 level terms selected for this model are labeled from 1 to 5: Ad-Hoc, Fragmented, Formalized, Managed and Continuous Improvement, as illustrated in Figure 5.
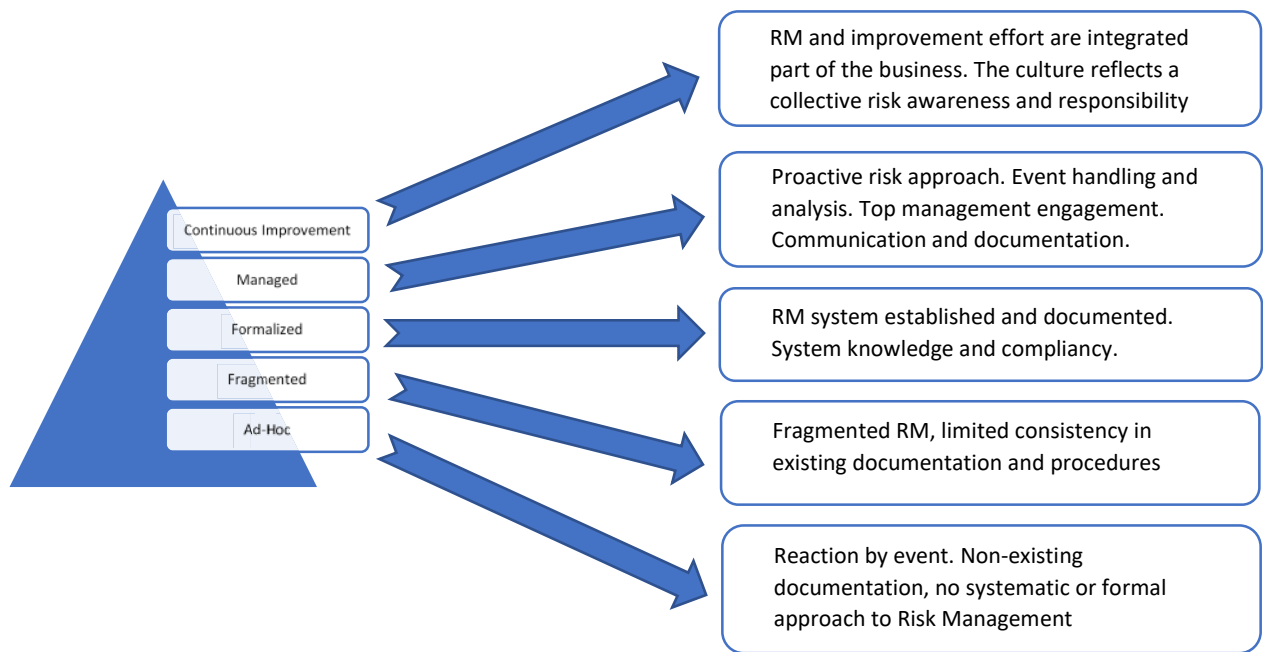
Figure 5: Compiled risk management maturity model

From the existing requirements set in DKS, 38 requirements were identified, and these requirements form the base of the model. Many of these requirements are described at a very high level (abstract and vague) and some are described as overarching goals. First, it is important to evaluate all requirements and further divide them according to their descriptive maturity level. This makes it possible to quantify and reallocate each requirement into lower and higher levels of maturity. For example, a requirement deemed to be assessed at level four according to figure 5, is then described according to the varying performance for maturity level one, two, three and five.

As an example, from DKS 1.1,1: *"Roles and responsibilities [for RM system] shall be identified and known in the organization,"* This statement was evaluated according to the maturity levels from figure 5, and then allocated into different maturity levels, as seen in table 2.

Table 2: Requirements quantified into maturity levels

Maturity level	1	2	3	4	5
1.1,1 *Roles and responsibilities shall be identified and known to all employees in the organization*	Not found: Roles and responsibilities are not described	Partly identified Partly described, but with shortcomings in more areas	Described in procedures Roles and responsibilities are known Might be some variations in understanding and knowledge	Implemented Very good knowledge and understanding at all levels Documented involvement from management	Continuous improvement documented

The initial application of the model is part of the maturity model development of this project. A few dry runs were performed to find improvements and adjust the model before going live with the new maturity assessments as part of an audit. The dry runs provided a quality check and validation of the levels and their descriptions, which was important to deconflict and streamline the content of the model. Once the first detailed version assessment sheet was completed, it was time to perform maturity assessments. The next step in developing the model was by using the model for assessments and gathering additional experience.

Due to Covid-19, the planned audit program was cancelled, and the initial plan was delayed by some weeks before it was possible to perform maturity assessments with the use of the new maturity model.

Participants received the documents in advance to be able to familiarize themselves with the model and prepare any clarifying questions prior to assessment. The model was presented to the stakeholders participating in the maturity assessment, who were encouraged to raise questions and offer feedback during assessment. Both the use and functionalities of the model and the maturity assessment itself, were documented using the test sheet. The participants followed the model systematically, concluded and documented assessed maturity level. During this session, the researcher mostly facilitated and moderated while the participants assessed the maturity score according to model and the group together agreed on the current level of maturity based on the level descriptions of the requirements. A feedback session after each assessment was helpful to document learning objectives and experiences. The last product from model development is the maturity assessment report. The report communicates identified status from assessment and the actions needed to reach the next level of maturity for RMS and was sent to all participants.

Application of the maturity model - discussion

This section evaluates the research performed and results attained against each of the respective research questions, and contains direct quotes from interviews interjected by way of illustration.

How to build a risk maturity model (RQ1). In the *Model development* chapter, I describe how I built the maturity model from existing requirements. I did not analyse requirements for validity and efficiency according to quality for RMS. The scope of this project was to improve compliancy to existing requirements.

Factors found to hamper risk maturity development (RQ2). Statistics from audit reports provided evidence of the stagnation in process improvement. It was important to find the sources and to understand the problem. I was able to identify different contributing factors to potentially hamper risk management development in the current environment. Table 3 summarizes these factors.

The root cause stems from a misunderstanding of the construct of the risk management system, to be "something on the side" versus essential to the core business. In dialog with representatives of different departments and units, they describe an understanding of the RMS to be a stand-alone system, where inputs and outputs are isolated from other daily business. Results from performing the maturity assessment, also confirm a low score on RM system integration. Requirement 2,1 states that Risk management shall be an integrated part of all activity (Forsvaret, 2010).

"Based on the product I receive from subdivisions prior to safety-council and managements review, I perceive risk management are processed on the side of business, and the quality follow."

Table 3: Identified factors to reduce maturity development today

• Optional to solve observations from audit	• Operationalization of requirements for RM system is missing
• Improvement effort do not get the right attention or resources	• RM system in not prioritized
• Low competency on regulations and requirements for RM system	• Roles and responsibilities for the RM system are missing
• Existing maturity level too low for self-development	• Top management not involved or do not communicate ambitions or goals
• Stand-alone RM system, poor integration to business processes	• Culture barriers, "We have always done it this way"
• Observations contain a poor description	• Not aware of organization's maturity baseline
• Established protocols for audit organization according to mandate	• Misinterpretation: no deviation=high maturity
	• Lack of internal control

Another interesting finding from interviews relates to the resources put to solve observations or improvement areas described in audit reports.

"*Development of the system or system maturity is not prioritized unless we have a deviation."*

While interviewees conceded that this was not an ideal situation, they reported that the focus of daily operations did not allow for resource allocation to improvement efforts.

"The knowledge and competency on the regulations and requirements for RM system is too low." Director Nesje (2020) knows that a reduced effort toward analysis and lack of operationalization of requirements will contribute to low maturity. Other reports also point out missing operationalization as one important reason for the shortcomings to implement the Risk Management System (Sivertsen and Gunnarshaug, 2015).

Representatives from audited departments were also asked if their organization communicates the status of their own RM system baseline. The responses suggested that this information does not exist, and it is not interesting or demanded from management to produce this information.

"As long as our management do not pay attention for develop of maturity, it will not help with such a tool-even if the tool is powerful. The management must really want to improve their organization before something will happen."

The motivation for improving the risk management system is missing and maturity above the mandatory requirements are not prioritized. It is in this area the maturity model would meet its purpose. The statement above, from an audited department, substantiates the statistics reported in figure 1, which showed observations to be approximately at same level since 2007. The statement also points to the source of where development has stagnated (Forsvarets materielltilsyn, 2019).

Other observations. During interviews with employees in NAFMSA, one of the respondents referred to the mandate. Maturity assessment is not described explicitly in the mandate and the feeling is that this is a potential obstacle when performing RMS maturity assessments (Nesje, 2020). However, as employees of NAFMSA, we believe that guidance and training are implied actions to support attitude and culture as crucial inputs to increase safety work as stated in official documents. The important actions beside control and audits are described on the website of NAFMSA in (Regjeringen, 2020, author's translation):

Equally important are guidance, training, and other attitude-creating work, as these contribute to the [audited]organization's ability to ensure safety in a good way.

The mandate does not describe maturity assessments explicitly but measures other than control are described as equally important. Measurements on maturity are conducted today, described in audit reports as improvement areas or observations. Performing maturity assessments is not considered a contradiction to either the mandate or existing practice, rather it is considered to frame a more systematic approach.

Another barrier raised during interviews is the existing competency for audit personnel because additional resources must be involved during audits if performing maturity assessments. We expect some extra resources performing audits and of course some transition cost building competence in the organization using the new format based on the model. Beyond these we do not believe this to be an issue.

The indicator that there is a low awareness of the current maturity in the organization came from interviews with audited departments. As reported, we tested the model and performed assessments based on the model as part of the project. These audits provide the first assessed maturity baseline based on the model. During interviews with the senior experts of NAFMSA, it was communicated that the use of the model may deliver a lower maturity finding when compared to established understanding of maturity level. The interviewed participants were asked their opinion of their current maturity based on the new model. They all replied with an assumption of a general maturity level in the sector to be level three/ three minus (Formalized minus). When we performed assessments with the use of the maturity model, maturity was assessed to level 2 or lower (Fragmented minus). Even if the seniors confirmed the effect of a lower assessed maturity with the use of a model, they still had a too optimistic impression.

How will a risk management maturity model influence the maturity development (RQ3)? We learn from literature and other industries, that a risk management maturity model could be an effective tool. As part of this project we developed a new maturity model that integrated the requirements for the defence sector to comply with. We used the model in practice and performed maturity assessments at 5 different departments. We gathered experience from development and use of the model and received important feedback from participants in the process. Here we discuss the application of the maturity model.

As shown in figure 6, the defence sector RMS maturity development curve is flattening out. The area above the red line (red line illustrates mandatory requirements), is our main area of interest. This is the area we want to influence for increased maturity, with the use of a maturity model.
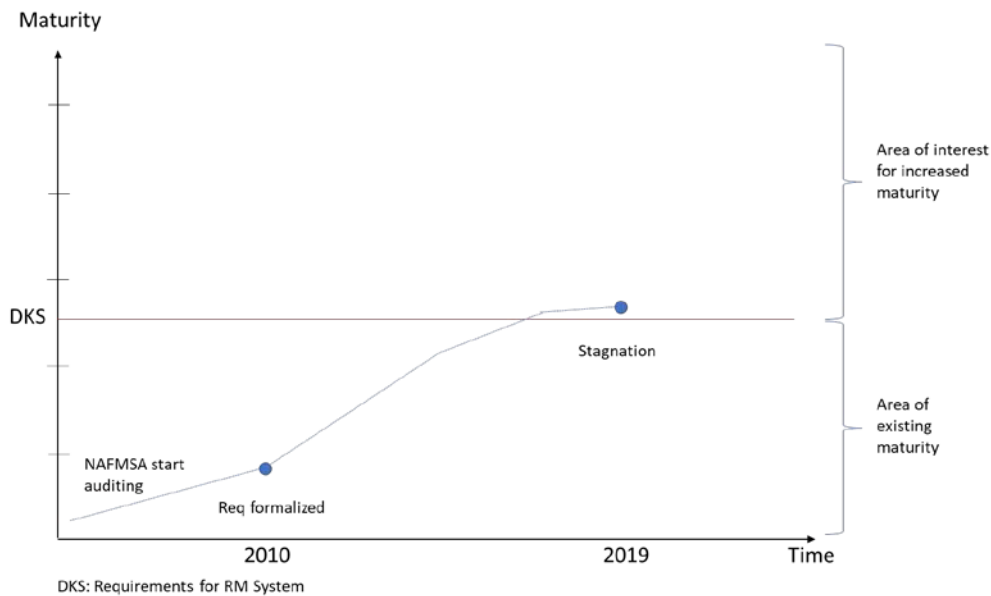
Figure 6: Assumed maturity curve, not based on exact data, but the assumption of historical development according to organizational evolution. Indicated stagnation point obtained from NAFMSA annual report (Forsvarets materielltilsyn, 2020)

Respondents from NAFMSA gave positive feedback during interviews of their opinion of the potential effect of the use of a maturity model in the organization. In recognition of current shortcomings in further organizational development they appreciated the arrival of additional support tools.

"We have a potential in the way we formulate our observations. Some of them are rather good, but we could improve in the way we formulate and give advice in audit reports."

Participants from the maturity assessments had a similar perspective based on their learning and experience during the sessions.

"The structured assessment as we follow the model gave useful insight to what is really expected from the requirements."

Knowledge about regulations is already identified as low, but to see the requirements used in the model, is expected to raise the competency in the organization. The offering of incremental smaller steps on the path to meet requirements as part of the maturity evolution is considered positive. During one of the maturity assessments, one of the participants stated that their personal competency regarding the requirements was increased during the session.

The use of a maturity model to support improvement of the RMS will hopefully influence resource allocation. After an initial transition period, since the model describes requirements in detail, the need for ongoing analysis and operationalization may demand less capacity to manage continuous improvement efforts.

"It is not because departments do not want to improve the RMS, the problem is the capacity to manage the system and the regulations."

The first response from one of the participants after a maturity assessment was the surprise of identification of the low maturity status. He had a perception of a more mature organization. The use of the model will increase the awareness of existing maturity level. A higher resolution on the evaluation criteria in the model, will help the audit team to perform a more uniform feedback. It will be easier to maintain the total picture, manage the sector and produce statistics for information and management according to mandate.

An unsolicited feedback received from one of the participants some weeks after maturity assessment was that he now believes the maturity model will contribute to a more systematic and targeted effort on the RMS matter in his organization. They had presented the assessment report in a meeting with management.

We also recently heard that the responsible office for managing the requirements for RMS admitted, after a recent evaluation of DKS, that the regulations do not fit the purpose and RMS need to be a more integrated part of the business management. This statement will anchor the need for improvements and potentially strengthen the relevance for a tool like the maturity model in support of communication and management.

May a risk management maturity model become a useful tool for self-assessments (RQ4).

"Organizations showing a low maturity baseline, will struggle with resources to develop own maturity. In order to conduct self-development, a certain level of maturity is needed to start with."

"Continuous improvement is only possible for mature organizations."

One of the experts talked about a "threshold-level" to be able to perform self-development (Nesje, 2020). We assume, from our maturity model, the organization will need to score close to or above level 4 before a self-development will be effective. Interviews with experts in NAFMSA assume most departments to have a maturity of 3 or lower, from our model. If correct, this indicates an extensive need for training and guidance to reach such a threshold level.

Experts from NAFMSA describe the possibility of a model to support self-assessments as a maturity issue. With a too low maturity or without an identified maturity baseline from previous maturity assessment, it would probably not be very effective. With guidance and support it would probably work but having an external moderator would be valuable for increased accuracy. For self-assessment to be effective, competency on both the requirements and the maturity model will be important. The competency for requirements is assessed to be low. This will increase demand for extensive training and probably an increased organizational maturity to start with. On the other hand, information found in the model will probably give a better overview of the requirements. In that perspective a model would help, but to be useful a tool may request more insight. Self-assessment may be part of a future perspective, after implementing the maturity model and reaching a higher maturity level in the organization. More than 50% of respondents were positive to use maturity model for self-assessment. Experts from NAFMSA consider the idea premature at this time.

"When performing self-assessment, it is easy to also include the organization's plans and intentions as part of the assessed maturity, with a reported maturity above existing level as a result."

Feedback and validation. We gathered feedback at different stages of the project, and any relevant comments, questions or findings were documented along the way. In addition to findings and

learning objectives as part of the action research process, feedback sessions were conducted after each maturity assessment. Introduction of a maturity model is a new concept for most of the stakeholders, in hindsight we see they needed some time to familiarize themselves before questions arrive.

We validated the maturity model construct and the use of the maturity model for assessments with the use of a survey. 12 respondents received the survey, which is based on a five-options Likert scale (Van Peer et al, 2012). 10 respondents handed in their answers as presented in figure 7 a. The survey was distributed after implementing maturity assessment, the respondents had at that time the experience from maturity assessment and the post-audit discussions. The results are summarized and discussed here.
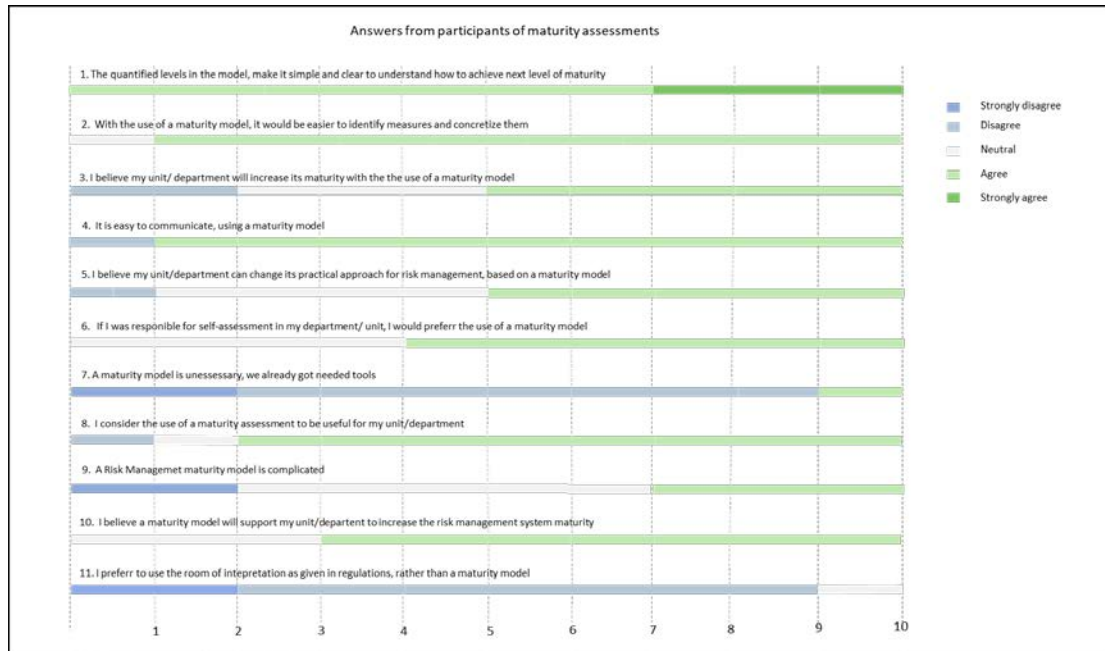

Figure 7: Results from survey, respondents from maturity assessments

(Statement 1) The respondents agreed unanimously that quantifying requirements into maturity levels contributes to understanding how to achieve the next level of maturity. All respondents agree to the statement where three of them strongly agree. The perception of the concept of risk management maturity model is experienced as easy and clear to understand.

(Statement 2) 9 out of 10 respondents agree that the model can help to identify and concretize measures for the organization. A strong majority of respondents believe a maturity model can help them with needed measures.

(Statement 3) The respondents were more divided. Five agree (50%) with the statement if they believe their own department will increase its maturity based on the model. Two responded their organization will not increase their maturity and three were not sure. In this question, the respondents must consider not only the model, but also their belief in their own organization and management. In conjunction with the two statements above, most respondents find the model itself to be an easy and helpful tool, but for some of them they do not believe in the practical impact of it. Additionally, three are not sure.

(Statement 4) A clear majority believe in the power of communication with the use of a model, one does not agree. Most of the participants got their first experience with a maturity model during this assessment and got the impression of the power of communication with the use of a model. Models used for communication with stakeholders are common within systems engineering community.

(Statement 5) 50% of the respondents agree and believe that their organization will change their approach to risk management in support of a model. One does not believe the organization will change its practice and four are not sure. This statement can be seen in conjunction with statement 3 and we see corresponding feedback.

(Statement 6) Above half of the respondents (60%) believe they would prefer to use a maturity model for self-assessment if it was their responsibility. The remaining 4 are not sure.

(Statement 7) This entry served as a control question to assess the consistency of the responses. Since 9 out of 10 disagree or strongly disagree with the statement and do not believe a maturity model is unnecessary. One respondent agree that a maturity model is unnecessary. The majority of respondents consider a maturity model to be a useful tool, which is well-aligned with other responses.

(Statement 8) Most respondents agree with the statement that maturity assessment based on a model could be useful for own unit/department. 8 respondents agree, 1 disagrees and 1 is not sure. This statement is well-aligned with responses to statement number 3. More respondents are confident that a maturity assessment model will be useful for their department; fewer respondents are sceptical that their department will increase the maturity level with the use of a maturity model.

(Statement 9) In this statement the respondents are divided about their perception that the new maturity model is complicated. Half of the respondents (50%) are neutral, 3 agree and think maturity model is complicated and 2 do not think it is complicated. Compared with statement number 1 this feedback could appear somehow in contradiction for some respondents.

(Statement 10) Most respondents believe that the maturity model will support their department to increase the maturity performance. 7 respondents agree and 3 are not sure, which shows a lack of consistency with other questions.

(Statement 11) For this statement, most respondents indicate a clear agreement that they do not want to use own interpretation of regulations over a maturity model and this is consistent with the responses to statement 1.

The overall results from the survey show that most of the respondents are positive to the potential influence of the maturity model to help improve the defence sector safety performance. They clearly support the simplification of requirements into a maturity model and agree it could be used to identify and concretize measures. The use of the model for self-assessments is supported by just above half of the informants, at the same time the remainder are neutral. We mainly see a positive attitude toward the effect of the model itself, but as we ask about the actual potential effect for their own department, we see slightly less positive result. Some informants seem to have a distrust of their own department when it comes to actual implementation and improvement.

This substantiates the indication from senior NAFMSA, who highlighted low competency on regulations and requirements in the defence organization as a factor. However, they are more confident that it will be easier to deal with requirements as divided and described in the model.

Reading the results from the survey, we must also consider the ease of reacting in a positive mindset while being introduced to something new. People are suspicious of an easy solution to a long-established challenge. For a maturity model to take effect, the effort must facilitate results. As Hillson (1997) points out, despite the existing consensus on the value of risk management, the implementations may not be effective, and this is important to communicate to the audience.

Conclusion and future work

The researcher began this project with little prior knowledge of CMM but through the literature review discovered that maturity models are described as effective tools to identify an organization's baseline of maturity and to increase the understanding of any gap that exists between existing and desired performance. This research resulted in the creation of a risk management maturity model and a proof-of-concept of the model in practice. Interviews and tests show the potential for an increased RMS maturity in the organizations of the Norwegian Armed Forces with the use of a maturity model. Signals from the professionals of NAFMSA and the audited organizations are positive in favour of the use of the maturity model for guiding continuous improvement in RMS performance.

Even in the short time of the project, NAFMSA have identified an increased systematization of improvement effort with the use of a model. A model supports effective communication, helps highlight status and identify tasks and needs. Participants from the assessments were able to appreciate the advantage of the use of a maturity model for their implementation and future maturity growth. In addition, the maturity assessment report will make it easier to communicate the status to management.

Both the systematic process and framework, part of the model and the content communicated, are considered important contributors for the model's effect. During the research, impeding factors for development of RMS in the organization were identified, and the maturity model was created with the objective to control more of these factors and guide them within a short- and long-term perspective. At this early stage in the use of the maturity model it is not considered to be very effective for self-assessment, because of the existing low maturity and competency within RMS throughout the organization. A model will not support the lack of managerial involvement in terms of strategy, goals, and daily management. A model would only support a desired change or direction if management and organizational culture facilitates it.

A student project is limited in time and resources, and the collected data is therefore limited. This project has provided a starting point for the use of a maturity model. To be confident in potential results, NAFMSA should follow up these pilot organizations that participated in the initial assessments. Since the maturity assessments in this project had to follow an alternative plan due to Covid-19, the maturity model should be tested as part of an audit. In addition to increase the number of tests for conformity, it is important to test the tool in the context of intended use. Requirements that may have been overlooked or themselves need refinement should be implemented in the model. As additional data is collected confidence should grow with increased use of the model and systematic continuous evaluation of the effect in use of a maturity model. A future extension of the model should also include risk culture as one of the assessed areas.

Acknowledgements

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Biography

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