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Goal Conflicts, Classical Management and Constructivism: How Operators Get Things Done

Leonie Boskeljon-Horst [1,*], Robert J. De Boer [2], Simone Sillem [3] and Sidney W. A. Dekker [4]

[1] Royal Netherlands Air Force Headquarters, Luchtmachtplein 1, 4822 ZB Breda, The Netherlands
[2] Department of safety management, SDO University of Applied Sciences, Doctor Kuyperkade 28, 3142 GC Maassluis, The Netherlands; robertjan.deboer@bwcc.nl
[3] Department of Values, Technology and Innovation, Faculty of Technology, Policy and Management, Delft University of Technology, Jaffalaan 5, 2628 BX Delft, The Netherlands; s.sillem@tudelft.nl
[4] Safety Science Innovation Lab, School of Humanities, Languages and Social Science, Griffith University, 170 Kessels Road, Nathan, QLD 4111, Australia; s.dekker@griffith.edu.au
* Correspondence: l.boskeljon.horst@mindef.nl or l.boskeljon-horst@tudelf.nl

Abstract: In this study we identify the differences in goal realisation when applying two conflicting paradigms regarding rule perception and management. We gathered more than 30 scenarios where goal conflicts were apparent in a military operational unit. We found that operators repetitively utilized certain routines in executing their tasks in an effort to realize several conflicting goals. These routines were not originally intended nor designed into the rules and not explicitly included in documentation. They were not necessarily at odds with the literal wording and/or the intent of rules and regulations, although we did find examples of this. Our data showed that local ingenuity was created innovatively within the frame of existing rules or kept invisible to those outside the unit. The routines were introduced and passed on informally, and we found no evidence of testing for the introduction of new risks, no migration into the knowledge base of the organisation, and no dissemination as new best practices. An explanation for this phenomenon was found in the fact that the military organisation was applying a top-down, classical, rational approach to rules. In contrast, the routines were generated by adopting a constructivist view of rules as dynamic, local, situated constructions with operators as experts. The results of this study suggest that organisations are more effective in solving goal conflicts and creating transparency on local ingenuity if they adopt a constructivist paradigm instead of, or together with, a classical paradigm.

Keywords: local ingenuity; goal conflicts; goal attainment; rule management; safety; productivity; expertise

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1. Introduction

Rules and regulations are a necessary resource in organisations to help people remember the steps in a task under challenging circumstances, to educate and train people for their jobs, to ensure that people can cooperate effectively for design and planning purposes, and as a means to identify variances in behaviour that are deemed unacceptable [1]. However, rules and procedures must not excessively restrict people to cope with the variances that they routinely encounter while they execute tasks [2,3]. Organisations typically suffer from a tension between these two paradigms [2,4,5], where management typically considers human behaviour as the cause of incidents and accidents, and safety as something to be achieved by designing safe systems and controlling human behaviour within that system [6]. Employees on the other hand pursue many goals (of which safety is one) by adapting to the variable conditions in which they work [7].

The overall aim of the present study is to identify how two conflicting paradigms regarding rule perception and management as described by Hale & Borys [1] affect goal realisation and the resolution of goal conflicts in an operational setting. To this end we aim to identify goal conflicts, examples of (possibly covert) routines to solve these goal

conflicts (called local ingenuity) and the contribution of these routines to goal realisation and the resolution of goal conflicts. We also aim to identify if these routines are known to management, whether they are aligned with the literal wording or the intent of rules and regulations, whether they have been assessed for risks, have been absorbed in the knowledge base of the organisation, and/or have been disseminated as best practice. Finally, we aim to identify the factors that aid or thwart the creation of these routines–in particular, the paradigms that are adopted by management and operators about rules.

The overall aim of the present study results in the following main research question: what are the differences with regard to goal realisation when applying two conflicting paradigms regarding rule perception and management as described by Hale & Borys [1]?

The subsequent research objectives are translated into the following sub-research questions:

1. Can examples of goal conflict and of local ingenuity be identified within an operational environment?
2. Is the sum of possible goal realisation improved in the examples of local ingenuity compared to the base case?
3. Are these examples of local ingenuity known to management?
4. Are the examples of local ingenuity aligned with the literal wording or the intent of rules and regulations?
5. Are the examples of local ingenuity tested for the introduction of new risks?
6. Are the examples of local ingenuity absorbed into the existing knowledge base of the organisation?
7. Have the examples of local ingenuity been disseminated as best practice?
8. What rule paradigms have been applied in the base case with goal conflicts and in the creation of local ingenuity?
9. How have these paradigms influenced the creation of local ingenuity?

These research objectives and questions have led the research initiative within an operational unit of a military organisation.

2. Literature Review

2.1. Goal Conflicts, Violations & Local Ingenuity

Applicable rules do not accurately represent all of the company's interests, such as productivity and efficiency pressures or particular deadlines [5,8,9]. These pressures are often tacit and not sufficiently represented in the rules, but they have an effect on the choices that are made in the moment. People will find shortcuts in tasks to get the job done, often instructed by more experienced colleagues. Because it is impossible to anticipate every possible work situation, it is seen as necessary to infringe on rules to accommodate the varieties in work situations [10,11]. Factors such as time pressure, lack of required information, knowledge, or expertise, and insufficient physical conditions of the workplace may create the necessity to execute a task in a non-compliant manner [12]. In this sense, goal attainment is facilitated by departures from documented rules and procedures, confounded by the fact that employees are unable to solve the causes of pressure and are therefore forced to adapt [13]. Management condones the departures, turning a blind eye without alleviating conflicts [6,14,15]. Rasmussen [16] has suggested that organisations continuously suffer from pressures of productivity and profitability that undermine safety barriers, and Hollnagel has similarly described trade-offs between thoroughness and efficiency [17].

2.2. Two Conflicting Views of Rules and the Covert Nature of Local Ingenuity

Within a top-down, classical, rational approach to rules inspired by reason-thinking ([18] termed model 1 by Hale & Borys [1]), rules and procedures are seen as desirable, necessary, and unavoidable ways to direct and control human behaviour. Violating these rules and procedures is seen as negative behaviour that needs to be understood in order to be suppressed, as every violation means a first step towards causing an accident [1]. Compliance to procedures is seen as synonymous for safe behaviour [19], because procedures control erratic human behaviour [20]. Enhancing knowledge on procedures and ensuring

compliance leads to progress on safety [6]. Hale & Borys [1] have listed the strengths and weaknesses of model 1, reproduced with elaboration from the paper in Appendix A.

An alternative view of rules is constructivist, viewing rules as dynamic, local, situated constructions of operators as experts (model 2 [1]). In this paradigm the reason for violating procedures is found in that multiple, conflicting, and implicit goals have to be achieved [6]. Dekker [19], substantiated by the research of Furniss et al. [21] and Schubel et al. [22], suggested a complex and unpredictable world of work in which a difference between the way work is assumed or imagined to be done and the way it is actually done is unavoidable. Rules are just one resource used by employees [2] and complex systems cannot be controlled by simply following the procedures [23]. Under the duress of goal conflicts, employees are able to execute their work because they are able to innovate and improvise outside the rules and procedures [19]. Particularly, being more efficient or more thorough than expected, being able to deal with a lack of resources, and delegating safeguards are ways found to get the work done [24]. Within this view on violations, rules and procedures are seen as local behavioural patterns that emerge from experience. Because rules can never completely cover every circumstance, translation and adaptation are inevitable and violations are necessary when rules and reality do not match [1]. Hale & Borys [1] have listed the strengths and weaknesses of model 2, reproduced with clarification from the text in Appendix A.

Mendoza et al. [5] found that management and operators had divergent expectations of how procedures are used, when they are most useful, and reasons why operators do not utilize the procedure amendment process. In essence, management tends to adhere to a top-down, classical, rational approach to rules (model 1), whereas operators tend to take a constructivist view, seeing themselves as sufficiently experienced to deviate when they feel this is necessary (model 2). Hale and Borys suggested a framework which combines strengths of model 1 and 2 and "places the monitoring and adaption of rules central to its management process and emphasises the need for participation of the intended rule followers in the processes of rulemaking, but more importantly in keeping those rules alive and up to date in the process of regular and explicit dialogue with first-line supervision" [25].

2.3. Local Ingenuity

As a result of the tension between the two paradigms of rule perception and management, routines exist that solve goal conflicts and become part of operators' regular repertoire, but are relatively invisible to management [3]. These routines might be a source of pride but are invisible to all but the inner crowd, as management's paradigm of full compliance effectively stifles any understanding and recognition for alternative routines. Rather, there may be repercussions and at least a push back on the routine, making it more difficult for the operators to achieve high goal realisation in future. We expect these routines to be repeatedly applied, passed on from employee to employee, and therefore relatively stable.

In contrast to many previous authors, we have dubbed these routines 'local ingenuity' (rather than non-compliances, deviations, gaps, or shortcuts), stressing the non-normative perspective that this research requires us to take. Note that in our definition of local ingenuity, these are not necessarily at odds with the literal wording, or the intent, of rules and regulations; however, the routines were not originally intended, have not been designed into the rules, and are not explicitly included in the current documentation. Because of their covert nature, examples of local ingenuity have likely not been assessed for risks, are not absorbed in the knowledge base of the organisation, and have not been disseminated as best practice.

2.4. Implications for This Research

As the literature shows, the assumption implicit within model 1 paradigm is that compliance leads to safety. However, research shows that accidents still happen despite full

compliancy [26], and non-compliance does not necessarily lead to less safety [27]. Safety is just one of many goals to be achieved in executing tasks, and so productivity and safety conflict with each other [28,29]. Employees find solutions to deal with goal conflicts, but little is known about how they achieve this through improvisations [30,31]. With this research we shed more light on the success of local ingenuity, whether in accordance with rules or not, within an operational unit of a military organisation.

3. Method

To study how two conflicting paradigms regarding rule perception and management affect goal realisation in an operational setting through the identification of local ingenuity, the authors chose to limit the research to the case study of a single target organisation. We chose a qualitative survey research methodology to enable collection of data over a relatively widespread sample of varying seniority of the employee population, supported by numerical analysis when appropriate.

3.1. Target Organisation

The study was conducted in a flight squadron within the Royal Netherlands Air Force (RNLAF) that was sought out because it was felt to be successful in creating local ingenuity. The RNLAF has formulated the ambition to improve its competitive advantage under the umbrella term "fifth generation air force," and it is thought that ways to improve goal realisation and resolve goal conflicts contribute to this initiative. Although the military nature of the operation means that not all research data can be made public, the researchers found the target organisation in initial talks to be more open about goal conflicts and possible violations than most commercial organisations.

The flight squadron is an operational unit encompassing 55 employees and around 30 aircraft. The squadron activities include flight planning, briefing, debriefing, line maintenance, and ancillary support activities. The squadron's home base is one of the Dutch air fields, but it is also active in other NATO countries for joint exercises, and on deployment missions elsewhere. The goals of the squadron under study are to maximise the individual's potential by developing his/her skills and building expertise, executing the missions assigned to the squadron by the air force commander and his/her delegates within the appropriate budget, and performing this safely. An overall RNLAF goal is being compliant with existing regulations, rules, and procedures. For this research, we have translated these objectives into four organisational goals: safety/security, building expertise (developing skills), productivity (expected performance), and compliance to rules and regulations.

3.2. Interviews

To collect data, semi-structured interviews were held with twelve people. This sample size represents 22% of the target unit and was deemed sufficient. Theoretical saturation had been reached as the final three interviews generated no new information regarding our research questions, resembling the 10 + 3 criterium [32–35]. In this case, theoretical saturation was achieved rather quickly due to the focused scope of the research question and the clarity of our topic [36]. The interviews displayed rich information in the sense that each generated multiple examples.

The interview guide included two main questions:

- Could you tell us about something that makes executing your job difficult?
- How do you deal with this?

All interviews were preceded with written and oral explanation of the aims and methods of the study, the way data was anonymised and stored, and how the study results are disseminated. Each participant signed an informed consent form attesting to their understanding and approval of the study. At least two of the three researchers were present during each interview. The interviews were not recorded. Notes were taken, processed

and validated by the interviewees for correct reflection. Notes were deleted and only the validated and anonymised interview data was stored.

3.3. Scenario Descriptions

The interviews resulted in 'scenario descriptions': a narrative describing a (base) case with goal conflicts, and (if applicable) a solution in which the sum of possible goal realisation was improved. We identified these solutions as examples of local ingenuity if they were aimed at solving goal conflicts, were not originally intended, were not designed into the rules, were not explicitly included in the current documentation, and were incorporated into part of the regular repertoire of the operator. We identified whether these examples were at odds with the literal wording, or the intent, of existing rules and regulations. All scenarios were described using the behavioural and psychological features Hollnagel et al. [37] proposed as guidance to analyse situations. In case different interviewees came up with the same base case, the stories were combined into one scenario. We excluded examples that were not directly pertaining to the target organisation. All scenarios were stored on a secure network, only accessible by the three researchers.

3.4. Coding

For each scenario, it was identified which goals were being pursued in the base case, and how goal realisation changed in case of local ingenuity. A goal conflict was defined as when one of the four organisational goals hampers the attainment of at least one of the other three goals. To determine the extent of improved goal attainment as a result of local ingenuity, a 5-point Likert scale was used with a mid-point neutral score. Scale labels for the safety/security goal ranged from severely more risky to severely less risky. For the goals of productivity and expertise, the scale labels ranged from greatly diminished to greatly improved. For each scenario, the non-compliance was determined for the base case and local ingenuity (if available) using a simple yes/no code. Non-compliance was considered to be either a breach of procedure or a violation.

To discern which paradigm regarding rule perception and management was utilised in each scenario for base case and local ingenuity, we used the strengths and weaknesses (characteristics) approach as described by Hale & Borys [1]. The application of these to identify the dominant paradigm in an operational setting is (as far as the authors are aware) novel. Clarification for the strengths and weaknesses of model 1 and 2 was derived from the original paper and made available to the researchers (see Appendix A). For each base case and each local ingenuity separately, the researchers scored the applicability of a characteristic using a 3-point Likert scale ranging from "the characteristic was apparent in the narrative" to "clear evidence that the specific characteristic was not applicable." The neutral point was labelled "doubt regarding the applicability of a characteristic." Cronbach's alpha was calculated to determine the internal consistency of the individual characteristics for each model. A high alpha result means the characteristics contribute evenly to the overall applicability (scenarios x characteristics of either model 1 or model 2). An $\alpha \geq 0.8$ is usually considered acceptable [38].

An interrater reliability was calculated for all variables using Fleiss' kappa, as there were more than two coders. Although clear guidance is unavailable on the appropriateness of values for Fleiss kappa [39], the authors deemed a Kappa ≥ 0.5 as acceptable.

4. Results

4.1. Interviews

Interviews were conducted with twelve employees of the target organisation, nine officers and three non-commissioned officers. All interviewees were males between the age of 25 and 45. An interview took on average one hour. After finalizing the narratives, these were validated by the interviewees, giving them the opportunity to correct any factual mistakes.

4.2. Scenarios

A total of 33 scenarios remained after testing against the criteria (subject to goal conflicts; pertaining to the target organisation); five were eliminated. Of these, 24 were directly related to the main task (flight operations and (training) missions) of the unit and nine were pertaining to maintenance and/or support. We considered the scenarios to constitute a non-compliance with existing rules, regulations, or guidelines in three of the base cases (9%, $\kappa = 0.86$). In two cases, these non-compliances were not visible to the organisation external to the unit studied. Four example scenarios are reproduced in Table 1.

Table 1. Four example scenarios.

Scenario 1: Requesting terrain for military training is accompanied by a quite a bit of administrative work and takes at least two weeks to complete. Following the prescribed procedures hampers the productivity of the unit and significantly reduces flexibility. To cope, all the necessary information to request terrain is summarised in one A4 page which is submitted to the authorities. This local ingenuity is within the existing rules. A copy is taken by the employees on the exercise. The productivity goal is hereby greatly improved. For the base case, the model 1 characteristics were predominantly applicable and the model 2 characteristics were not. The characteristics of model 2 are applicable to local ingenuity. Some of the model 1 characteristics are applicable to local ingenuity, some are not, and some can neither be confirmed nor disproved.
Scenario 12: From civil airports, it is not allowed to take off after sunset. Civil airports are used as an alternate in case of an emergency. It this is the case, there is a chance that once landed, it will not be possible to leave on the same day, creating the challenge of securing the aircraft, disrupting productivity, and impacting the main task of the unit. No local ingenuity accompanies this base case. No non-compliance was found. Model 1 characteristics are applicable to the base case and model 2 characteristics are not.
Scenario 13: Military personnel may have to use violence to attain a military goal. Rules of engagement (ROEs) describe the circumstances, conditions, degree and manner of violence that is allowed. Interpreting the ROEs can be difficult in some situations, resulting in the risk of unwantedly breaking these rules. The resulting conservative attitude negatively impacts the safety and expertise goals. Within the existing rules, a briefing is constructed by an employee, which provides more background and clarity of the ROEs. This briefing results in less safety risk and improved building of expertise. Model 1 characteristics are applicable to the base case and model 2 characteristics are not. The reverse is found for local ingenuity.
Scenario 28: Employees are obligated to have certain rules and procedures physically with them when training, of which most are digitally stored on iPads. Finding the right procedure during training takes time and effort, negatively impacting the safety and productivity goals. Within the existing rules, a master pdf file is constructed, which encompasses short cuts to all the necessary rules. This turns the digital documents into one master file. Both the safety and productivity goal are improved, diminishing the goal conflict with the compliance goal. No procedures pertain to either the base case or local ingenuity, resulting in model 1 and 2 characteristics neither confirmed nor disproved for this scenario.

4.3. Local Ingenuity

We found examples of local ingenuity within 22 of the 33 scenarios. These were screened against the criteria (aimed to alleviate to goal conflicts; not originally intended or designed into the rules; not explicitly included in the current documentation; part of the regular repertoire of the operator; pertaining to the target organisation) and none were eliminated.

We considered the examples of local ingenuity to constitute a non-compliance with existing rules, regulations, or guidelines in twelve cases (55%, $\kappa = 0.94$). This varied from the breach of a self-determined learning goal to the violation of a flight rule. In seven of these twelve cases, the examples of local ingenuity were not visible to the organisation external to the unit studied. There were no cases where a non-compliance in the base case was changed into a compliancy by local ingenuity.

4.4. Goal Conflicts

For all but two scenarios, a goal conflict between the compliance goal and at least one of the other organisational goals (safety, productivity, or building of expertise) was determined, impeding the achievement of these latter goals. The interrater reliability for determining which of the organisational goals is negatively impacted by the compliance goal was sufficient ($\kappa \geq 0.85$ for each organisational goal).

As per definition, goal attainment opportunities were found in each scenario. A total of 54 opportunities were found—15 for the safety/security goal, 9 for the building of expertise goal, and 30 for the productivity goal. We found that in nearly all scenarios (30 of the 33), productivity was negatively impacted by the compliance goal and in most scenarios (20 of the 33), the attainment of two organisational goals was hampered by the compliance goal. Most common combination found was safety/security and productivity (twelve instances), followed by building expertise and productivity (six instances), and safety/security and building expertise (two instances). In one instance, all three goals were negatively impacted by the compliance goal.

The 22 examples of local ingenuity had a positive effect on goal attainment, particularly building expertise (six instances) and productivity (19 instances). The change was either 'improved' or 'greatly improved'. Not in all cases was the riskiness of local ingenuity increased versus the base case; in fact in some cases, it was reduced. In four instances, local ingenuity improved the attainment of the safety/security goal. In four other instances however, local ingenuity increased the safety/security risks. In all cases of an increased risk, this was limited to 'slight'. Local ingenuity within the bounds of existing rules and regulations resulted in improvements in the safety, expertise, and productivity goals in, respectively, three, five, and ten times out of the twenty attainment opportunities. Where local ingenuity constituted a non-compliance with existing rules, regulations or guidelines, it resulted in improvement of the safety, expertise, and productivity goals in, respectively, one, one, and eight times out of the fourteen attainment opportunities and resulted in an increased safety/security risk for three of the fourteen opportunities.

4.5. The Characteristics of Model 1 and Model 2 for the Base Cases

Our research endeavoured to identify rule management paradigms by using model 1 (top-down, classical, rational approach to rules) and model 2 (constructivist view) characteristics. In this section, we report the results of our analysis on the base cases. As indicated in the methodology section, we scored the applicability of the characteristics using a 3-point Likert scale in which a + indicates the characteristic is applicable, a − indicates the characteristic is not applicable, and a 0 indicates there is doubt regarding applicability.

Based on the coding, we found that the characteristics of model 1 were predominant for most base case descriptions (26 out of 33, $\kappa \geq 0.56$), as indicated by the overall + scoring visible in Table 2. Two of these base cases had no existing rules or procedures that are applicable, hence the model 1 characteristics cannot be used, indicated by all 0 scores. For the remaining five base cases, the model 1 characteristics could neither be confirmed nor disproved, also indicated by all 0 scores. With regards to model 2, we found that the characteristics were not applicable for most base case descriptions (27 out of 33, $\kappa \geq 0.63$), as indicated by all − scores. For the other six base cases, the model 2 characteristics could neither be confirmed nor disproved because no existing rules or procedures were applicable, as the 0 scores show.

Cronbach's alpha was calculated to determine the internal consistency of the characteristics and showed good overall internal consistency for model 1 ($\alpha = 0.93$) and model 2 ($\alpha = 0.99$). However, two characteristics of model 1 seemed less relevant to our data set. "Proven effectiveness for simple, 'golden rules'" (Behavioural Based Safety) ($\kappa = 0.27$) and "Emphasises the role of organisational complicity in rule violation" ($\kappa = 0.85$) were predominantly scored neutral. The low Kappa value of the former is explained by the high agreement between coders in 30 of the 33 cases.

Table 2. Results of model 1 and model 2 for the base cases.

	Model 1																				
	Strengths								**Weaknesses**				**Strengths**						**Weaknesses**		
Scenario	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	+	0	+	+	+	0	0	0	0	+	+	+	−	−	−	−	−	−	−	−	−
2	+	0	+	+	+	0	0	+	+	+	+	+	−	−	−	−	−	−	−	−	−
3	+	0	+	+	+	0	0	+	0	+	+	+	−	−	−	−	−	−	−	−	−
4	+	0	+	+	+	0	0	+	0	+	0	+	−	−	−	−	−	−	−	−	−
5	0	+	+	+	+	0	0	+	0	+	+	0	−	−	−	−	−	−	−	−	−
6	0	0	0	0	0	0	0	0	0	+	+	0	−	−	−	−	−	−	−	−	−
7	+	+	+	+	+	+	+	+	+	+	+	+	−	−	−	−	−	−	−	−	−
8	+	+	+	+	+	0	0	+	+	+	+	+	−	−	−	−	−	−	−	−	−
9	+	+	+	+	+	0	0	+	+	+	+	+	−	−	−	−	−	−	−	−	−
10	+	0	+	+	+	0	0	+	+	+	+	+	−	−	−	−	−	−	−	−	−
11	+	−	+	+	+	0	+	+	+	+	+	+	−	−	−	−	−	−	−	−	−
12	+	+	+	+	+	0	0	+	+	+	+	+	−	−	−	−	−	−	−	−	−
13	0	+	+	+	+	0	0	+	+	+	+	+	−	−	−	−	−	−	−	−	−
14	+	+	+	+	+	0	0	+	+	+	+	+	−	−	−	−	−	−	−	−	−
15	+	+	+	+	+	0	0	+	+	+	+	+	−	−	−	−	−	−	−	−	−
16	+	0	+	+	+	0	0	+	0	+	+	+	−	−	−	−	−	−	−	−	−
17	+	+	+	+	+	0	0	+	+	+	+	+	−	−	−	−	−	−	−	−	−
18	+	0	+	+	+	0	0	+	0	+	+	+	−	−	−	−	−	−	−	−	−
19	+	0	+	+	+	0	0	+	0	+	+	+	−	−	−	−	−	−	−	−	−
20	+	−	+	+	+	0	0	+	−	+	+	+	−	−	−	−	−	−	−	−	−
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	+	+	+	+	+	0	0	+	+	+	+	+	−	−	−	−	−	−	−	−	−
24	+	0	+	+	+	0	0	+	0	0	+	+	−	−	−	−	−	−	−	−	−
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	+	0	+	+	+	0	0	+	0	+	+	+	−	−	−	−	−	−	−	−	−
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	+	+	+	+	+	0	0	+	+	+	+	+	−	−	−	−	−	−	−	−	−
30	+	+	+	+	+	0	0	+	+	+	+	+	−	−	−	−	−	−	−	−	−
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	+	+	+	+	+	0	0	+	+	+	+	+	−	−	−	−	−	−	−	−	−
33	+	+	+	+	+	0	0	+	+	+	+	+	−	−	−	−	−	−	−	−	−

Legend: + indicates the characteristic is applicable; − indicates the characteristic is not applicable; 0 indicates there is doubt regarding applicability.

4.6. The Characteristics of Model 1 and Model 2 for local ingenuity

In this section, we report the results of our analysis on the local ingenuities. We found that the characteristics of model were predominantly not applicable for the examples of local ingenuity (17 out of 22, $\kappa \geq 0.62$), as indicated in Table 3 by mostly − scores. For the remaining five local ingenuities, the model 1 characteristics could neither be con-

firmed nor disproved, as indicated by the 0 scores, because no existing rules or procedures were found to be applicable. We found that the characteristics of model 2 were predominant for most of the local ingenuity descriptions (18 out of 22, $\kappa \geq 0.53$), as indicated by mostly + scores. For the remaining four local ingenuities, the model 2 characteristics could neither be confirmed nor disproved, as shown by the 0 scores, because no applicable rules or procedures were found.

Cronbach's alpha was calculated to determine the internal consistency of the characteristics and showed good overall internal consistency for model 1 (α = 0.86) and model 2 (α = 0.91). Again, the characteristic "Proven effectiveness for simple, 'golden rules'" (Behavioural Based Safety) seemed less relevant to our data set (κ = 0.15, explained by the high agreement between coders).

Table 3. Results of model 1 and model 2 for local ingenuity.

	Model 1												**Model 2**								
	Strengths								**Weaknesses**				**Strengths**						**Weaknesses**		
Scenario	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	+	0	−	+	+	0	0	−	0	−	−	−	+	+	+	+	0	+	−	+	−
2	−	−	−	−	−	0	+	+	−	−	−	−	+	+	+	+	+	+	+	+	+
3	−	−	−	−	−	0	+	−	−	−	−	−	+	+	+	+	+	+	+	+	+
4	−	−	−	−	−	0	0	−	−	−	−	−	+	+	+	+	+	+	+	+	+
7	−	−	−	−	−	0	0	−	−	−	−	−	+	+	+	+	+	+	+	+	+
9	−	−	−	−	−	0	0	−	−	−	−	−	+	+	+	+	+	+	+	+	+
11	−	−	−	−	−	0	+	−	−	−	−	−	+	+	+	+	+	+	+	+	+
13	−	0	−	−	0	0	0	−	0	−	−	−	+	+	+	+	+	+	0	−	−
14	−	−	−	−	−	0	+	−	−	−	−	−	+	+	+	+	+	+	+	+	+
16	−	−	−	−	−	0	0	−	−	−	−	−	+	+	+	+	+	+	+	+	+
18	−	−	−	−	−	0	+	−	−	−	−	−	+	+	+	+	+	+	+	+	+
19	−	−	−	−	−	0	+	−	−	−	−	−	+	+	+	+	+	+	+	+	+
20	−	−	−	−	−	0	−	−	−	−	−	−	+	+	+	+	+	+	+	+	+
21	0	0	0	0	−	0	0	0	0	0	0	0	0	0	0	0	0	+	0	0	0
22	0	0	0	0	−	0	0	0	0	0	0	0	0	0	0	0	0	+	0	0	0
24	+	0	−	−	+	0	0	−	0	−	−	−	+	+	+	+	0	+	−	−	−
25	0	0	−	−	+	0	0	−	0	−	0	−	+	+	+	+	0	+	−	−	−
26	−	−	−	−	−	0	+	−	−	−	−	−	+	+	+	+	+	+	+	+	+
27	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	+	0	0	0
28	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	+	0	0	0
29	−	−	−	−	0	0	−	−	−	−	−	−	+	+	+	+	+	+	+	+	+
30	−	−	−	−	−	0	+	−	−	−	−	−	+	+	+	+	+	+	+	+	+

Legend: + indicates the characteristic is applicable; − indicates the characteristic is not applicable; 0 indicates there is doubt regarding applicability.

5. Discussion

In this study we aimed to identify what the differences were with regard to goal realisation when applying two conflicting paradigms regarding rule perception and management as described by Hale & Borys [1]. We report on the findings of a study at an operational squadron of a military organisation. The results are based on 33 scenarios that have been collected through half-structured interviews, and that have been analysed for goal conflict, goal attainment, non-compliances, and the characteristics of model 1 or model

2 thinking [1]. We show that goal conflicts were frequently solved locally with routines that optimize across multiple conflicting goals, dubbed 'local ingenuity'. These routines are not necessarily at odds with the literal wording, or the intent, of rules and regulations; however the routine is not originally intended, is not designed into the rules, and is not explicitly included in the current documentation.

5.1. Scenarios

Our first aim was to identify goal conflicts and local ingenuity. The results show that the 33 scenarios describe a goal conflict between four organisational goals: to improve safety or security, build the expertise of the employees, and/or increase productivity or budget utilisation. These base cases were seen as situations in which (according to those involved) there was a potential for improvement of the realization of these goals. Local ingenuity was used to realise those goal improvement opportunities for the flight, (training) mission and maintenance/support base cases as expected [10,11,40].

5.2. Local Ingenuity

In 22 of the 33 scenarios that were collected, an adjustment to work was identified to alleviate tension between conflicting goals (i.e., local ingenuity further supporting our first aim). These examples support Hollnagel [4] (p. 40) and Dekker [19], who described gaps between what is written about how work should be done and what is actually done, and how this is a result of the efforts to capture a non-deterministic and complex world into rules and procedures. Regarding our fourth sub-research question, we found that local ingenuity is in some instances aligned with the intent or the literal wording of rules. In some cases (45%), we found that employees were able to solve goal conflicts within existing rules and procedures. However, in 55% of cases (12 out of 22), some rule, regulation, or guideline was violated; in many cases (7 out of 12) this was due to the solution not being visible outside the target organisation, providing the answer to our third sub research question as to the knowledge of management about local ingenuity. These results suggest that the process of "keeping the rules alive and up to date in the process of regular and explicit dialogue with first-line supervision" (cf. Hale & Borys [25]) is failing. We also aimed, as indicated by our fifth, sixth, and seventh sub research questions, to identify if local ingenuity is formalized. We found that, irrespective of whether local ingenuity was compliant with existing rules and regulations or a non-compliance, we saw limited proof of it being tested for (new) risks, it being incorporated into rules and regulations, or it being disseminated to other units. Exceptions were scenario 11, in which local ingenuity was tested for (new) risks, and scenario 13, in which local ingenuity was shared with other units.

5.3. Goal Conflicts and Goal Opportunities

We found goal conflicts between the compliance goal and the three other organisational goals in all of the scenarios as predicted by the literature [16]. Our second research aim was to identify if goal realisation was improved by local ingenuity. We found that applying local ingenuity in the 22 of 33 scenarios led to an overall increase in goal attainment of safety/security, productivity, and/or building expertise, regardless whether local ingenuity was based on perceived freedom within rules or on lack of visibility. Not in all cases was the riskiness of local ingenuity increased versus the base case; in fact, in some cases, it was reduced.

To illustrate the goal conflict between the internal compliance goal and the organisational goals as well as the effect of local ingenuity on goal attainment, we plotted both the base cases and the local ingenuities found in two 2 × 2 frameworks [41], as seen in Figures 1 and 2.

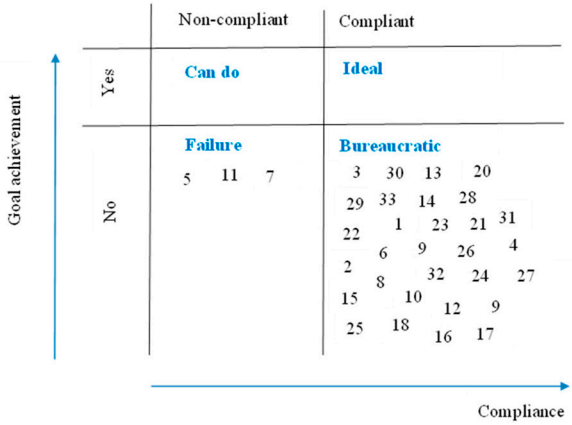

Figure 1. Compliance x goal achievement for the base cases (N = 33).

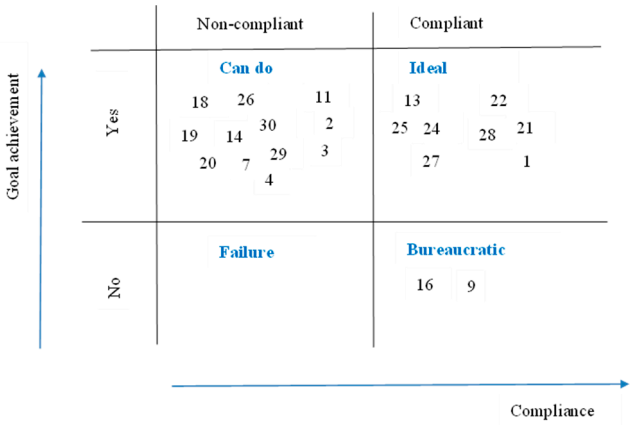

Figure 2. Compliance x goal achievement for local ingenuity (N = 22).

As Figure 1 shows, the conflict between the compliance goal and the other organisational goals resulted in compliance in 30 out of the 33 three scenarios, but goals were not achieved in any of these cases. Local ingenuity of the employees resulted in 20 out of the 22 instances in goal attainment (Figure 2). The resulting non-compliance was the consequence of the desire to seize goal improvement opportunities. Being compliant and achieving goals, however, is not necessarily an ideal situation; in some cases, the intent of the rules was not complied with, although in a literal sense there was compliancy. In other cases, we found that the rule base was not challenged or modified despite examples of local ingenuity that should have triggered a change in rules (local ingenuities 1, 21, 22, and 28).

In only three base cases, we encountered non-compliances, whereas we found twelve as a result of local ingenuities. The quadrupling of the violations was expected, as they were the result of finding a quicker way to do the job, the design making compliance difficult or even impossible [42], the rules lacking an understanding of the working situation [8], conflicting demands [43,44], and a lack of worker involvement in rulemaking [45]. In the cases in which local ingenuity led to non-compliances, we identified a small increase in the safety risk with three violations. However, we also identified a decrease in the safety risk with two other non-compliances and an increased improvement in productivity in all non-compliances.

5.4. Model 1 and Model 2

Finally, as reflected in our eighth and ninth sub research questions, we aimed to identify what rule paradigms are applied and how they affected the creation of local ingenuity. According to the interviewees, the lack of transparency on local ingenuity in this organisation was heavily compelled by an approach to rules and compliance that aligns

with the characteristics of model 1 [1]. We found that in the organisation's approach to potential for improvement of the attainment of organisational goals (i.e., the base case), a model 1 alignment was predominant and there was no alignment with model 2 characteristics. The organisation's approach to local ingenuity met most of the characteristics of model 2, and few of the characteristics of model 1. Goal conflicts are more likely and more persevering with model 1 as a result of the rigid way of looking at work. Only by taking on a model 2 perspective was local ingenuity stimulated, and therefore the achievement of conflicting goals possible. In those cases in which a model 2 approach was not possible (e.g., due to high visibility outside the unit studied), local ingenuity was smothered and goal achievement seemed sub-optimal. In those cases in which local ingenuity was evident however, we found that there was a lack of model 1 thinking, resulting in a lack of clear procedures to support task execution and to train others, and for organisational design purposes [1]. In case of non-compliances as a result of local ingenuity, these were continuous and went entirely unmanaged except at the unit level, effectively leading to the complicity of superiors.

The characteristic "Proven effectiveness for simple, 'golden rules'" (Behavioural Based Safety) of model 1 turned out to be problematic when coding the scenarios in the target organisation. We found this characteristic in only one base cases and none of the local ingenuities. Behavioural Based Safety is a concept not embraced within the RNLAF, explaining this result. The characteristic "Emphasises the role of organisational complicity in rule violation" of model 1 also seemed to pose a problem. The lack of applicability with the base cases is explained by a lack of non-compliances. For local ingenuity, this characteristic is found to be applicable in six cases of non-compliances.

5.5. Effectiveness of a Workplace

The results of our study confirm downward pressure on local ingenuity as a consequence of a predominant focus on model 1 thinking to the exclusion of model 2. The opportunity for local ingenuity is limited to caveats in the rules and regulations or local ingenuity is invisible to others outside the operational unit (including the rest of the military organisation). Because local ingenuity (be it compliant or not) is largely invisible, it is not tested for (new) risks, not incorporated into rules and regulations or the Safety Management System, and not disseminated to other units.

In some instances, we found merely cosmetic compliance (i.e., to the literal wording of rules, not the intention). When compliance becomes impossible while trying to solve problems, employees come up with entirely different task executions, that provide a way to work around the problems and still fall within the rules, just different rules than the problems conflict with.

5.6. Limitation of the Study

Since the topic of goal conflicts is considered gender-neutral, we suspect gender has had no impact on the conclusions drawn in this study, despite having only males as respondents. The unit participating in the research is an all-male unit. Female employees are scarce within the operational domain of the RNLAF and, if present, a minority. However, we conducted one interview with a female working closely with the unit as a control, which generated identical scenarios and examples of local ingenuity. In future research, it could be valuable to look at possible gender differences when studying local ingenuity.

5.7. Theoretical Contribution

Our research contributes to the existing literature on model 1 and model 2 thinking by showing that the characteristics can be used to discern which of the paradigms about rules have been adopted in a particular situation. This novel application has empirically confirmed the existence of two conflicting paradigms for rule management, a top-down, classical, rational approach to rules (model 1 according to Hale & Borys [1]) and a constructivist view (model 2).

We found that one needs to tailor the taxonomy of goals to an organisation when conducting an investigation into goal conflicts, rather than subsuming to the generic classifications in the literature. Our taxonomy of safety/security, productivity, and building expertise turned out to be useful to illustrate goal conflicts in all 33 scenarios. Adding the overall internal goal of being compliant to our taxonomy seemed more illustrative than the simple bi-polar ETTO assumption [17] and more tailored to this organisation than the Dynamic Safety Model [16], which encompasses only organisational goals.

5.8. Practical Contribution

Our research contributes to practice by adding more nuance when comparing compliance to non-compliance. The findings show that a predominant focus on model 1 to the exclusion of model 2 hampers the effectiveness of the unit studied. Being compliant and achieving goals is not necessarily an ideal situation; in some cases, the intent of the rules was not complied with, although in a literal sense there was compliancy. In other cases, we found that the rule base was not challenged or modified despite examples of local ingenuity that should have triggered a change in rules. With this research, a way to identify and describe the effectiveness of the entire RNLAF becomes possible. It also provides a way to enhance the effectiveness of the organisation.

5.9. Recommendations

Based on our findings, the military organisation is advised to consider an approach to rules and regulations and local ingenuity that combines the strengths of model 1 and model 2. This includes well-defined autonomy (freedom-in-a-frame), a responsive attitude to rule modifications, operator input, and (dynamic) management of exceptions to meet the complexity of the operation. This well-defined autonomy means that operators feel trusted to resort to alternative compliance when performing their job. This could mean to deviate from rules and procedures, which is explained to peers and supervisors and is done knowingly and responsibly. This requires an organisation to make use of the expertise and professionalism of its employees, as found in local ingenuity, but not yet in the rules and regulations. In case of alternative compliance, a normative debrief takes place after the task is executed to evaluate the action chosen against goal realisation and possible risks, closing the feedback loop. This normative debrief ensures (a limited) control and the possibility to learn from successful solutions. It is also a way to gain insight in the possible role of personal interests that might conflict with the interests of the unit or organisation. We hardly encountered this in our research, only in one scenario. A normative debrief can help aligning these different interests.

Hidden local ingenuity prevents a discussion regarding its appropriateness. Compliant but constrained local ingenuity cannot be deliberately applied by an organisation. Both situations are undesirable from an organisational perspective. The examples of local ingenuity–and the eleven cases in which no local ingenuity was devised despite a goal conflict–justify that rules should allow for a certain autonomy (freedom-in-a-frame) such as proposed by De Boer [3], and that a balance needs to be found with the five goals of rules (remembering the steps of a task, to educate, to cooperate effectively, for planning and design purposes, and to evaluate behaviour) [1]. If neither of these purposes is fulfilled by a rule, the rule makes no sense. Furthermore, in some instances, rules do not match reality because they have been written dislocated in time and place from the execution of work, sometimes resulting in an increased safety risk when complying to these rules [3]. In these instances, operators need the skills to recognize that not complying is necessary, which the organisation should legitimize.

In our study, the required equilibrium had not been found, as in none of the cases had local ingenuity been integrated into the rule base. In fact, this equilibrium has not been actively sought, parties instead opting in nine cases to keep local ingenuity within the unit and therefore hidden from entities outside the own unit.

Operators also need to be able to prioritize goals when goal conflicts occur. This cannot be set in stone, as each situation is different. Depending on the nature of the rules (legislation versus work procedures) and the task to be executed (safety versus productivity for instance), different choices can and will be made. What is needed is a recognition that goal conflicts are common and a predominant focus on compliance will hinder goal realisation.

As a result of our study we hope to be able to close the gap between local ingenuity and the rules and regulations, by testing local ingenuity for appropriateness under specific conditions and integrating it into the rule base [3]. The steps and success of this path will be reported in a next paper.

5.10. Next Steps

Hale and Borys [1] identified characteristics of both model 1 and model 2, and indicated whether they considered these strengths or weaknesses. The authors suggest a framework which combines strengths of model 1 and 2 which "places the monitoring and adaption of rules central to its management process and emphasises the need for participation of the intended rule followers in the processes of rulemaking, but more importantly in keeping those rules alive and up to date in the process of regular and explicit dialogue with first-line supervision . . . " [25]. The authors propose a field test of their approach. De Boer [3], building on the work of Hale and Borys, detailed how such a framework might be implemented. The author also indicated how significant changes to working practices might first be tested under controlled circumstances to check for unwanted side effects [3].

6. Conclusions

In this study, we aimed to identify what the differences were with regard to goal realisation when applying two conflicting paradigms regarding rule perception and management, as described by Hale & Borys [1]. We gathered more than 30 scenarios where goal conflicts were evident within an operational unit of a military organisation.

Goal conflicts were frequently solved locally with routines that optimize across multiple conflicting goals, dubbed 'local ingenuity'. These routines were not necessarily at odds with the literal wording, or the intent, of rules and regulations; however, the routine was not originally intended, was not designed into the rules, and was not explicitly included in the current documentation.

In this organisation, local ingenuity was either created within the existing rule base or invisible to those outside the unit, suggesting that the process of "keeping the rules alive and up to date in the process of regular and explicit dialogue with first-line supervision" is failing. The examples of local ingenuity were not tested for the introduction of new risks, did not become part of the knowledge base of the organisation, and were not disseminated as best practices.

An explanation for this phenomenon was found in the fact that the military organisation, using the wordings of Hale and Borys [1], was applying a top-down, classical, rational approach to rules. We found clear evidence that the RNLAF is using the model 1 paradigm in each of the 33 scenarios, to the exclusion of the model 2 paradigm. The model 1 paradigm focuses on a priori devised rules and procedures that encompass the best way to do the work and is unable to encapsulate the dynamical complexity of a work floor. It is expected that the target entity is typical for many other organisations.

In contrast, the examples of local ingenuity followed from a constructivist view of rules as dynamic, local, situated constructions of operators as experts. This shows that the top-down, classical, rational approach to rules is insufficient to understand how work is done. The model 1 focus is constraining the development and transparency of local ingenuity and results in the inhibition of goal conflict solutions. Local ingenuity is suboptimal, leading to overall suboptimal effectiveness of the unit studied.

The results of this study suggests that organisations are more effective in solving goal conflicts and creating transparency on local ingenuity if they adopt a constructivist

paradigm combined with a classical paradigm. This includes well-defined autonomy (freedom-in-a-frame), a responsive attitude to rule modifications, operator input, and (dynamic) management of exceptions to meet the complexity of the operation.

We consider the results useful for other organisations resembling the RNLAF. This includes, first of all, the other departments within the Defence organisation, such as the Royal Army and Royal Navy. Considering the fact that the compliance goal is the same throughout the entire Defence organisation, it is highly likely it will lead to goal conflicts and creative goal resolution within the army and navy as well. Furthermore, we expect any organisation, such as the Dutch Defence organisation, that has a firm compliance goal that creates pressure on other organisational goals, will no doubt find intriguing local ingenuity. Since this research was conducted within a military organisation with all male interviewees, it could be interesting to see if the results regarding goal conflicts, the creation and execution of local ingenuity, and goal realisation would be the same in a non-military organisation with both male and female interviewees. This would require more research.

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Data Availability Statement: All anonymized or aggregated data will be uploaded to 4TU.ResearchData with public access. Due to security/confidentiality reasons only a subset of the generated data will be made available. To access the full data a formal request can be made to the Department of Defense of the Netherlands.

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Appendix A

Table A1. The strengths and weaknesses of model 1 and 2 [1] and used clarification.

Model 1 Strengths		
1	Emphasis on written nature of rules to facilitate checking by regulators for non-compliances	"Emphasis on the scrutiny of writte documentation"
2	Consequences of violations are clear and explicit	"Emphasis on the detection of non-compliance."
3	Management and SME's are most competent in making the rules, which are imposed on the operators	"Rules are devised by experts that are not part of the workforce, to prevent errors and mistakes of the workforce, who are seen as more limited than the experts in their competence and experience."
4	Based on Scientific Management, a rationalist and prescriptive approach to rules	"Rules are seen as a best practice, the one best way to perform a job."

Table A1. *Cont.*

	Model 1 Strengths	
5	Action rules are used to describe the best way to do the work, which are easy to follow for novices	"Because novices do not yet have their own action rules and/or are not able yet to derive them from process rules, they need, at least temporarily rules from experts imposed on them."
6	Rules are the 'gold standard' for correct behaviour (Behavioural Based Safety)	"BBS, visible in observable rules, schedules of observation and feedback provided, is used to ensure compliance."
7	Organisational complicity as a result of violations in case rule compliance conflicts with productivity demands	"This characteristic is only visible when a non-compliance has been detected."
	Model 1 Weaknesses	
8	Sees operators as dumb robots that have to follow the rules that are imposed on them	"Operators need not to bother themselves with thinking about rules and exceptions, just following them or asking management what to do in case a rule cannot be complied with."
9	Violations and errors are voluntary, negative actions, committed by employees that think they know better	"Violation is always wrong and blame worthy"
10	Sees rule-making as a one-off, static process; rules only need modification when the work changes significantly or an accident happens	"Rules are carved in stone, the threshold for rule modification is rather high."
11	Encountered exceptions can only be dealt with by rule book growth	"If operators cannot comply with a rule, management will come up with new rules as a solution"
12	The focus on written rules results in a gap with reality; if rules do not match reality a modification of reality is needed	"Model 1 starts from the written rules and deduces from them that actions are compliances or violations. Modify reality to match the rules."
	Model 2 Strengths	
1	Operators as seen as the real experts central to rule making	"Operators know the complexity of the work and are hence the experts needed for rule making."
2	Key to rule use are experience, expertise, construction of meaning and sense-making	"Using of rules is based on both individual perceptions and judgements as well as group processes in which the applicability of rules is determined."
3	Rule-making is a continuous, dynamic process that is never complete	"Rules need to be adapted and translated to be used."
4	Relates abstract, generic, written rules to the flexible, local interpretation visible in routines	"Tacit rules or emerging expert rules are based on experience and socially constructed. They constitute organisational memory on how to deal with situations and change as a result of new experiences and learning."
5	Recognises the importance of exceptions of written rules and sees adaptations not as violations	Reality is much more diverse than rules give credit for which makes violations inevitable, a positive necessity.
6	Placing centrally experience, competence and ability to adapt	"Experience, competence and ability to adapt guide if, when and how to deviate from procedures."
	Model 2 Weaknesses	
7	The making and changing of rules happens locally which lacks transparency for regulators and creates learning difficulties for novices	"Rules are not always written, making it difficult to check for risks or for novices to get familiar with them. There is no rule modification process."
8	Undervalues the need for the organisation to explicitly manage the use and development of rules	"Changing the rules and their definition fundamentally to match reality. If rules are not described and/or the way to do something is not transferable, this characteristic is not applicable."
9	Differences in interpretation and competence/experience are not visible	"It is unclear whether "the knowledge to vary and adapt the procedures is [. . .] present", or whether "mistrust of rules leads to needless violations of them". If the difference between erroneous deviation and professional deviation is clear and visible, this characteristic is not applicable."

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