Report

Training for Operational Resilience Capabilities (TORC): 1st Concept Elaboration

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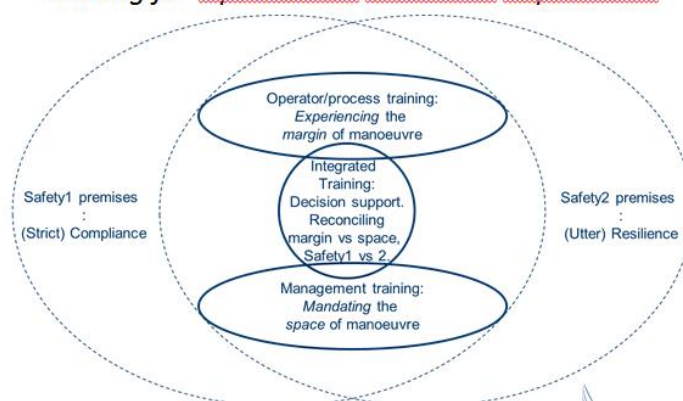
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ABSTRACT
Based on the SAF€RA (http://www.safera.industrialsafety-tp.org) project Training for Operational Resilience Capabilities (TORC), this report describes a first elaboration of a conceptual approach to operational and managerial training of resilience. The TORC project aim is to develop a generic training program that constitutes generic capabilities of resilient functioning in the context of a compliance-oriented safety regime. Hence, TORC aims to develop an innovative training concept that enables organizations to appreciate, nurture and improve their inherent resilient and adaptive capacities, while being under the imperative of predominantly compliance-oriented safety regulations and standards. Training is addressed both at the operational and managerial level, including guidance for the calibration of such a training program in order to adapt it to the specific organizational context (history, aspiration, constraints, etc.). The overall initial framework and thinking (rationale, objectives, training philosophy etc.) as well as key concepts will be described, aiming for a parallel piloting activity in different industries and European countries. The methodological approach, including the concept and framework development based on the pilot projects, will be presented, as well as the potential contribution to the understanding of Resilience Engineering.

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ABBREVIATIONS

AC	Adaptive Cluster
CvR	Compliance versus Resilience
CSF	Contributing Success Factor
DSHA	Defined Situation of Hazard and Accident
NASA	National Air and Space Administration (US)
REL	Response-Execution-Leverage
REWI	Resilience-based Early Warning Indicators
RICO	Resilience In COntext
R1	Resilience (in context) level 1
R2	Resilience (in context) level 2
R3	Resilience (in context) level 3
R4	Resilience (in context) level 4
SREL	Stratified Response-Execution-Leverage
TE	(TORC based) Training Element
TF	(TORC based) Training Format
TORC	Training for Operational Resilience Capabilities
TS	(TORC based) Training Strategy
TT	(TORC based) Training Target
WAI	Work as imagined
WAD	Work as done

INTRODUCTION

The aim of the TORC project is to develop an innovative training concept that enables organizations to appreciate, nurture and improve their inherent resilient and adaptive capacities, while being under the imperative of predominantly compliance-oriented safety regulations and standards. Hence, the pragmatic aim of TORC is confined to the aspiration of enabling organizations to operate and function more resiliently under such circumstances, rather than the aspiration of transforming them on the whole according to idealized or optimized forms of resilient systems.

The TORC approach is to identify and address actionable contexts and pragmatic situations from which the TORC aim can be pursued and operationalized. For that purpose, the TORC concept is founded on the 'Compliance vs Resilience' (CvR) relations (Grøtan, 2015) which is a concept resting on the premise that safety is in danger of being "trapped" by rules and procedures (Bieder and Bourrier, 2013).TORC is developed and piloted in collaboration with industrial organizations that recognize the CvR relations as a relevant pragmatic context, both from a managerial and operational point of view.

The TORC intention is also to facilitate a process by which *resilient functioning* as an *organizational property*, despite its inevitable "bottom-up" character, is appreciated, explicated and brought, not only out of the "contextual shadow" of compliance to rules, but also under a measured degree of *managerial* intent, supervision and accountability. TORC hence invites and supports organizational adaptations with managerial involvement, intent and consent, based on feedback of operational experiences of resilience that are elicited by reflection on action. In this way, a repository of (un)successful resilient dynamics is built, providing the seeds for the successive growth and maturing of resilience capabilities.

This document is the first deliverable of the TORC project. It represents the outcome of the initial work completed by the research team to review the notion of resilience and its potential added value for the development of a specific training for senior managers (designers and decision makers), front line managers and front line operators. The aim of this document is to define a theoretical framework to articulate resilience, safety management and training. It also intends to set up a practical framework for the development of the intended training. However, the overall progress of this practical research will obviously be incremental in nature. This means that both the theoretical and practical frameworks mentioned above may considerably evolve along the next steps, while interacting with each other during the development and execution of the training with the industrial partners involved in the TORC project. Consequently the current deliverable should not be considered sufficiently solid for its publication as a stand-alone document.

This deliverable reflects the pragmatic standpoint that the research team has decided to adopt: the intended training will have to take place in a "world of compliance", i.e. a world in which the dominant, socially and legally demanded strategy for safety is grounded on the anticipation of all potential situations and on the total compliance to corresponding predetermined responses. In that world, adaptive capacities of front line operators, such as adaptations and initiatives, are easily seen as precursors of non-compliance, and consequently as a threat for safety, quality and overall performance. In the "ultimate world of compliance" the possibility for adaptations and initiatives should be reduced as much as possible if not eliminated as a whole. In other words, in this context resilience behaviours at the individual or team level are ultimately perceived as antagonistic to compliance, hence to safety. In the perspective of the "world of compliance", safety through resilience may be considered to be an immature strategy, intrinsically unable to provide the extreme levels of safety required from ultra-safe systems (nuclear, aviation, rail, on/offshore drilling). While we recognize that this antagonism mainly results from a naïve vision of compliance and a simplistic vision of resilience mechanisms, we acknowledge the need to use this widely shared bias as a starting point for a resilience-oriented training.

The TORC project aims at overcoming this false antagonism at a practical level based on a theoretical framework that recognizes the differences in foundations, but at the same time facilitates a dynamic reconciliation of principles of compliance and resilience, aimed at strengthening resilient capabilities. Hence, TORC training also aims at being a vehicle for a productive *co-creation* of *functional and effective rules* (that is, compliance) and *trustworthy and reliable adaptive capacities* (that is, resilience), in conjunction.

The TORC project is a cooperation between 3 research partners SINTEF (Norway), TNO (Netherlands) and Dédale (France) in cooperation with industry partners from Norway (Eni Norge), France (DSNA) and Netherlands (NAM, IMBV and Strukton Rail).

The Project is financially supported by SAF€RA partners Research Council of Norway (RCN) and the Fondation pour une Culture de Sécurite Industrielle (FonCSI) of France, and by participating research and industry partners.

1 TORC Training Rationale

1.1 Aim and approach

The <u>aim</u> of the TORC project is to develop an innovative training concept that enables organizations to appreciate, nurture and improve their inherent resilient and adaptive capacities, while being under the imperative of predominantly compliance-oriented safety regulations and standards. In practice they will be embedded in safety management systems and operational procedures and rules. Many industries especially highly regulated ones like oil and gas, railways and air traffic have reached high performance levels due to condensed knowledge and guidance by the development of their "ecosystems" of rules. The back side of this development is that it inherently narrows down the space of maneuver for people in operations, leaving less space to their potential ability and need to cope with everyday demands that are not accommodated by, or even impaired by the predominance of rules. The theory and practice of resilience engineering opens a complementary perspective on business management relying on compliance. It is aimed at preparing the organization at all levels to cope with variance, disturbances in operations especially in complex systems and networks etc. Also, it emphasizes that normal work to some extent is variable, and that events and experiences may lead to adaptations with negative (unwanted) as well as positive (appreciated) outcomes.

Hence, the pragmatic *aim* of TORC is *confined* to the aspiration of enabling organizations and humans to operate and function *more resiliently* under the imperative of compliance, rather than the aspiration of transforming them on the whole according to idealized or optimized forms of resilient systems. TORC aims at enabling a balance between rule-centric and adaptation-centric behavior of people (Figure 1), teams and organizations, thus strengthening the necessary capabilities supporting flexible adaptations, decision making and growth through shifting competence envelopes. TORC seeks to make a difference through a training approach that facilitates reconciliation between the complementary perspectives of compliance-driven and resilience-driven management, decision-making and action. This approach requires organizational resources complementary to operational procedures, but also the capabilities of professional people in both implementing and supporting (resilient) operations. As a result, TORC needs to involve both the input from field staff at the sharp end of organizations and from their supervisors and managers (the blunt end). A key element is to facilitate the "running" creation of insight that is necessary to deal with trade-offs between compliance and adaptations and the inherent dilemmas on the one side, as well as decision making and deploying necessary action by adaptations in a "controlled" way on the other side.
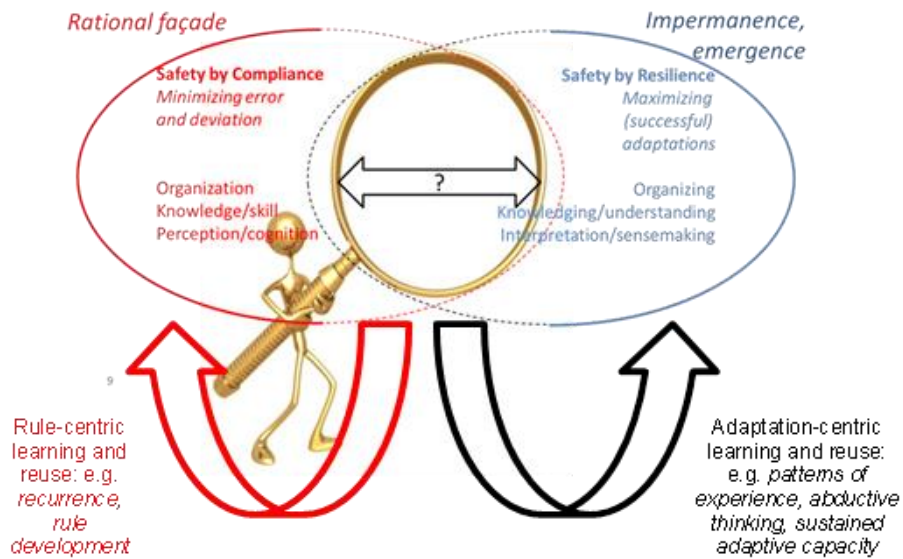
Fig.1. Rule-centric and adaption-centric approaches of TORC

The TORC approach is to identify and address actionable contexts and pragmatic[1] situations from which the TORC aim can be pursued and operationalized by staff as well as management. For that purpose, the TORC concept is founded on the proposition that the 'Compliance vs Resilience' (CvR) relations (Grøtan, 2015) encircle such a pragmatic context. In addition, TORC is developed and piloted in collaboration with industrial organizations that recognize the CvR relations as a relevant pragmatic context, both from a managerial and operational point of view. The recognition of the CvR relations signifies not only an appreciation of the problem of predominant belief in the powers of prediction as an aspect of traditional safety management, but also the recognition of a more overarching and institutionalized imperative of "ruling by rule" that manifests in a whole range of situations and contexts for industrial or public systems, e.g., in design, commissioning, operation and maintenance as a way to improve towards more reliable systems. The dilemmas this introduces has been discussed extensively in the literature (Hale and Borys 2013, Grote 2009).

As indicated in Figure 2, this implies that the concept of CvR relations carries no claim of contributing to the *explanation* of the functioning of a resilient system based on concepts of, e.g., advanced control loops, complex adaptive systems or other functional abstractions derived from systems science. Nevertheless, as also indicated in Figure 2, this does not preclude that TORC can take advantage of, e.g., Resilience Engineering as a rich source of concepts and issues. The condition for doing this is however that the selected parts can be 'translated' into the CvR context, and that they can be combined with recognized principles for training in general.

The TORC approach thus rests on the assumption that the presence of adaptive[2] properties is a necessity for work and functioning (not only) in complex operations by people in a diversity of organizational roles and

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[1] In the terms of a philosophy of science, the TORC approach can be framed as a 'double hermeneutic' (DH) aspiration; an attempt of *understanding an understanding subject*, rather than the more prevalent scientific agenda of *explaining an object*. Although the latter approach more directly invites influence through design and modification, the DH approach also provides a potential leverage for scientific influence, but on different terms and conditions.
[2] Tacit or unappreciated, as seen from the managerial position

tasks. The TORC approach is hence an attempt to make visible, reinforce and develop such *rudimentary[3] resilience* by means of systematic training, both at the operational and the managerial level. Hence, properties of resilience will be introduced under the presumption that they can be recognized by their resemblance with characteristics of situated practices of, e.g., an air traffic controller, maintenance crew, roughneck or offshore platform staff. The situated practices may however be labeled and spoken of differently than by the notions and concepts that are used within the scientific parlance on safety and resilience.

Fig.2. TORC approach

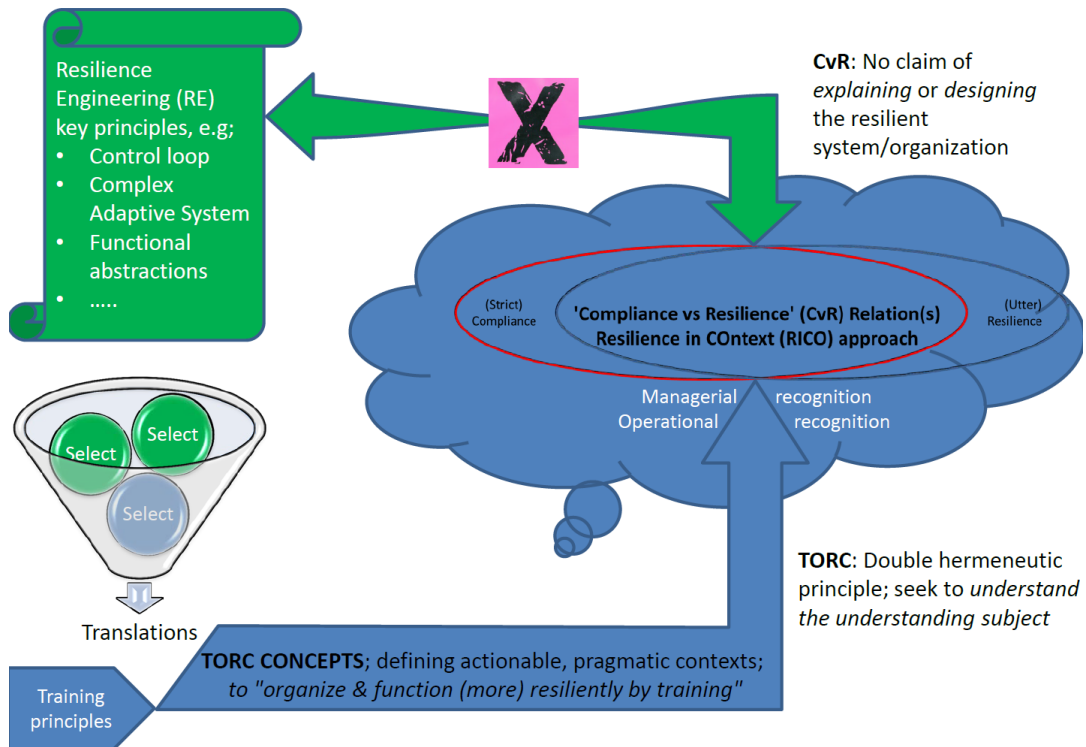[3] The label "rudimentary" is first and foremost meant to signify that it is not (yet) brought forward as a legitimate and sanctioned part of the organizational repertoire. It might be functional and complete on its own ("tacit") premises, but it might carry a potential of improvement that is not unleashed before it is "approved" and thus can involve additional parties and/or management processes.

1.2 TORC Foundations

1.2.1 Oppositions as (dialectical) drivers for progression

The TORC approach is founded on deliberate and continuous attention towards three specific constellations that are inherent to the CvR relations;

1. Reconciliaiton of the Compliance versus Resilience (CvR) opposition
2. Reconciliaiton of the "Work as Done" (WAD) versus the "Work as Imagined" (WAI) opposition
3. Reflection on action in order to elicit and reflect on resilient in practice during operations, and as part of explicit trade-offs in operations (as part of the learning organization).

The CvR relation is important not only because it accommodates two different and seemingly opposing principles[4] for how safety can and should be achieved, but also because their relation is asymmetrical. That is, the TORC point of departure is that resilience will unfold in the context of compliance. This context poses a constraint not only on the conditions *for* functioning resiliently, but also a potential shadow hiding or denying the potential *merits* of resilient practice. Hence, resilience as an organizational property is positioned in the "contextual shadow of compliance" (Grøtan, 2013) where even its positive contributions may remain unappreciated. This *imperative of compliance* is ubiquitous at every level, both inside and outside an organization seeking to develop its (rudimentary) resilience further, and it is also a prime mediator for the never-ending FBC[5] pressure. That being said, compliance ("Safety 1") as a safety strategy is not wrong per se, it is functional, efficient and even foundational in many respects and under specific conditions. It may however, in the worst case, inhibit people and teams from choosing safer and more effective (that is, resilient) paths of work when necessary.

The CvR relations are thus the primary underlying orientation for TORC. They are "disharmonious" in the sense that they accentuate and maintain an opposing contrast between different notions of and rationales for safety. This stance does however not purport to accommodate neither the full picture nor all nuances of safety in complex environments. It is first and foremost considered to be a useful theoretical position for the purpose of addressing and developing adaptive capacities under the (ubiquitous) imperative of compliance, specifically as a scope of training in which a deliberate and dynamic reconciliation between adaptation and rule adherence/guidance is sought.

The second underlying theoretical position is the distinction/opposition between "Work as Imagined" (denoted "WAI") and "Work as Done" (denoted "WAD"). Also this opposition rests on an underlying asymmetry with respect to status and impact within the organization; WAD is primarily associated with the realm of the operational, while WAI is primarily associated with the realms of design, engineering and management. As indicated in Fig.3, the WAD versus WAI opposition can be used to depict two possible fundamental mismatches that can be derived from the CvR relation, namely the possibilities that

a. (" \ ")[6] WAI by management (as an expression of a normative position) is predominantly and ingenuously compliance-oriented, while WAD (by operational staff, by necessity) is resilience-oriented but lacks managerial appreciation and attention to what is actually happening, or

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[4] "Safety 1(I)" vs "Safety 2(II)" See Hollnagel et al., 2013 and Hollnagel, 2014.

[5] "Faster, better, cheaper"

[6] Example: the "\" of Fig. 3 can be found in operations when the procedural context of work defining work as expected to be done is not properly designed for the work and the situation where a particular task has to be done. This may be the case when a service crew needs to work on an asset or in a work place layout that has been redesigned without proper management of change. The service crew has to interpret the situation and may decide with their knowledge that they are capable to do the job safely

b. (" / ")[7] WAI maintains an unrealistic and naive faith in (e.g.) extensive double-checking, operator's mindsets , risk awareness and other traits of resilience, while WAD is actually performed "by the book" due to experiences/expectations of rigid accountability patterns and blame-games when[8] something actually goes wrong.
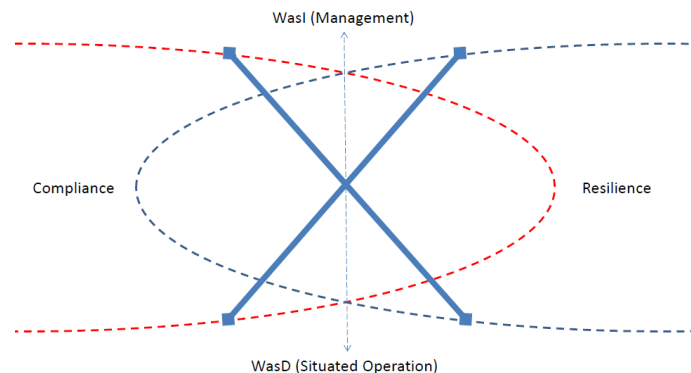

Fig.3. Two potential mismatches that TORC aims to counteract

The very foundation for the TORC approach is thus that resilient functioning can be gradually built by means of reconciling the CvR and WAI/WAD oppositions in a continuous and vigilant manner, however without insisting on permanent or persistent alignment. That is, the TORC approach is founded on the presumption that the appreciation of the inherent *dialectics* embedded in the two opposites may be a key driver for being able to keep pace with the evolving challenges posed by complexity and emergence in high-risk systems.

The third foundation addresses the need to create insight in how adaptations are developing and experienced, and how this impacts (which) frontiers or safety barriers are anticipated, approached or affected. This foundation urges for the facilitation of dialogue, coordination and decision support for instantaneous adaptations by field staff in tight cooperation with management, on the job as well as reflecting on it after the task has been accomplished.

Continuous learning resulting from these dynamics leads to a repository of resilient practices. This supports management to evaluate the effectiveness of and adapt their CvR strategy, and to allocate or develop organizational resources that support resilient capabilities in an effective manner.

1.2.2 Aspiration levels for resilient functioning

Resilience is per se a comprehensive concept with many different meanings, and even growing in that respect (Longstaff et al. 2013, Woods 2015). For TORC, a set of *types* or *levels* is regarded as instrumental in order to train and develop for capabilities of resilient functioning in a gradual, stepwise and accumulative way. Available conceptualizations (e.g., Woods 2015, Longstaff et al. 2013) are however regarded as too specific and too comprehensive to be positioned as normative in the context of the TORC approach. However, they can be mobilized and offered as a theoretical inventory further down the road of a TORC training process, e.g. for the purpose of elaborating and deepening the pragmatic context as (TORC) training creates higher awareness and maturity.

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[7] Example of the "/" of Fig. 3 can be found in operations in which the management overrates the crew's ability to deal with changing circumstances and disturbances, and consequently fails to offer necessary support and attention.
[8] That's is, WAI may be unilaterally held up as the rationale for accountability and punishment when things actually go wrong

As a generic framework for the TORC approach and rationale, the following levels or grades will be used to signify a progressive set of aspiration levels for resilient functioning[9].

- *R1*. **Defend** normalcy (preferred mode of operation)
- *R2*. **Build** robustness to anticipated disturbance
- *R3*. **Stretch** and rebound in an (isolated) surprising/unexpected situation/episode
- *R4*. **Sustain** resilient functioning over time

As aspirations increase from R1 to R4, this scale commence from a relatively simple notion of a well-defined and confined response based on a specific protocol or heuristic, or even a predefined or learned strategy. At the other end, resilient functioning may take the form of a more boundless intra- or inter-organizational mobilization; as an ultimately *emergent* response to a *novel* challenge or demand. The timeline of this progression may vary, e.g., depending on changing strategy in operations or on organizational level in the long run, reflecting maturing capabilities.

1.2.3 Bringing the resilient "fresh produce" under managerial accountability

Taking this possibly wide span into the TORC scope, "resilience" is by any means an emerging "fresh produce" which must be maintained, refreshed, reinforced and renewed. Training and rehearsal is an essential part of such an endeavor. Essential parts of TORC training are thus to make people become:

1. aware of their actions and their *efficiency and thoroughness trade-offs* (Hollnagel, 2009a), and the consequences from these
2. able to reflect on their activities when they adapt due to instantaneous needs, e.g, in ways in which they are acting beyond company rules, predictions or expectations.

Based on these premises, TORC aims to enable and facilitate a systematic effort of training in order to bring forward, recognize, "label", nurture, develop and bring resilience under managerial influence, control and accountability, in a stepwise and measuredly balanced way. The intended effect is to facilitate a process by which *resilient functioning* as an *organizational property*, despite its inevitable "bottom-up" character, is appreciated, explicated and brought, at least partly, out of the "contextual shadow" of compliance, and also brought under a measured degree of *managerial* intent, supervision and accountability.

1.2.4 CvR reconcilations

With resilience inevitably positioned in a *complementary*, *dialectical* and *shaping* relation with compliance (Figure 4) as signified by the persistent CvR relation, the rationale for TORC-based training is not confined to resilient functioning in the strictest sense. TORC training also aims at being a vehicle for a productive *co-creation* of *functional and effective rules* (that is, compliance) and *trustworthy and reliable adaptive capacities* (that is, resilience), in conjunction. CvR reconciliation thus also implies an act of mutually measured CvR *calibrations*, aiming for increased resilience as well as for optimization of rule effectiveness and efficiency. A persistent attention to the reconciliation of the CvR relations will presumably contribute to a favorable climate and support for the inevitable (efficiency-thoroughness) trade-offs that will have to be made at a more micro level.

This means that, e.g., in the case of a sudden decline of performance of a machine, field staff may need to decide how the delay or decline of quality of their work may be coped with; to wait for a backup, or to choose an alternative way to finalize their task, e.g. by considering to deviate from a standard operational procedure.

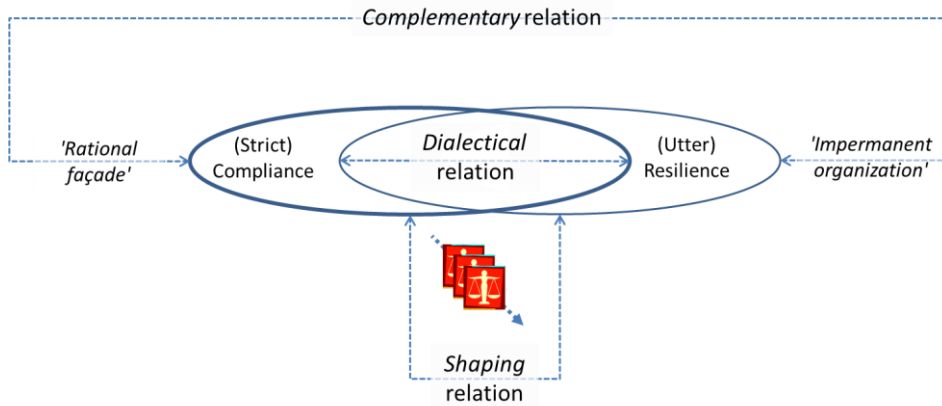[9] NB!; here; in the context of compliance

Fig.4. The CvR relations (Grøtan 2015)

This will however not be possible if there is a persistent mismatch between WAI and WAD (see Fig. 3) - irrespective of whether the mismatch is caused by unconcern, ignorance or sheer neglect. A continuous attention to the WAI/WAD opposition and its reconciliation is thus seen as a requisite as well as a tool for accomplishing productive CvR reconciliations. The comprehension of the term "compliance" per se is highly context-dependent and situated. There is thus a need for a flexible interpretation when seeking CvR (and WAD/WAI) reconciliations. The "resilience in context" (RICO) (Fig. 5) approach suggests a *possible*[10] shape for a stepwise CvR reconciliation consistent with a graded resilience scale.
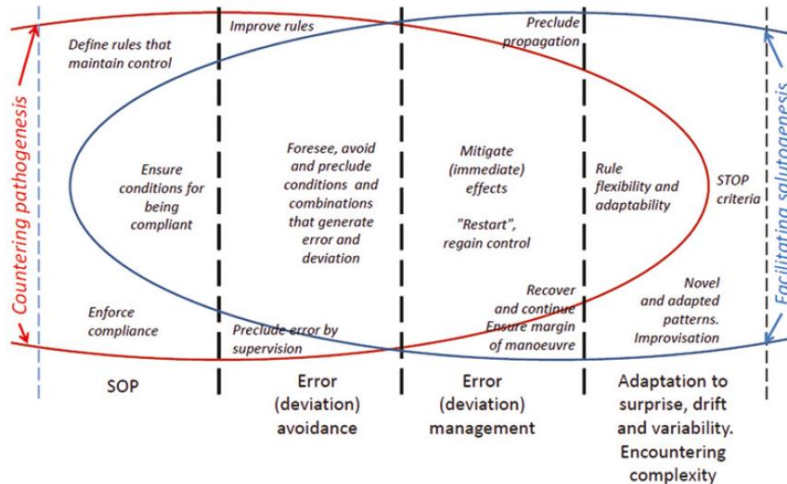
Fig.5.RICO approach (Grøtan 2014)

The actual need for a "level" of resilience may change during the course of action. That is, a shift to another level may be needed to cope e.g. with new emergent demands, with anticipated changes in need for resources, or foreseeable consequences of a planned response. The resulting shift to a more adaptable and

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[10] Note that the "scale" in Fig.5 is not exactly similar to the levels R1-R4 introduced in chapter 1.2.2, but it is consistent enough to illustrate the point regarding CvR reconciliation

flexible "compliance" to rules may require management engagement as part of the response strategy, e.g. to organize decision support and appropriate resources.

1.3 The presumed non-linearity of resilient functioning

The TORC approach aims for a *gradual development* of capabilities of resilient functioning. The training process is thus

- *contextualized* by the accompanying need for active CvR reconciliations,
- *conditioned* by continuous attention to WAI/WAD reconciliations, and
- *evaluated and recorded* by means of repositories of resilient practices, providing input to adaptation at the organizational level.

The challenges to be encountered under such a progression can unfortunately not be depicted as a clean-cut linear scale of gradually improving on a uniform set of properties or elements. The TORC scale is as non-linear as the more precise definitions[11] it is inspired by. The very *character* of the challenge encountered and resolved will change along the progression during the course of adaptations in action, and must also be captured in the reflection after action. This is implied by the underlying complexity issue that in its very essence motivates resilience as a distinct organizational safety strategy complementary to the compliance strategy. Hence, also the *characteristic* of the stepwise resilience *capability* may have to be revised in a longer perspective. Some key implications can be envisaged through the *Law of Stretched Systems* (Woods, 2014), as follows.

- "Far from" versus "near" **boundaries** is a major divide with respect to the changing character of the challenges addressed by TORC training.
  - o "Far from" and "near" implies radically different challenges and opportunities for adaptive failure[12] with potentially serious consequences.
    - ▪ "Far from" implies (resilience-wise) that a safety margin to a large extent can be built on (short-term) anticipation of contingencies, cascade effects and preparation for absorption of inherent variability, occasionally and episodically, without seriously challenging or exceeding the system's inherent limits of responsiveness.
    - ▪ "Near" implies (resilience-wise) that the safety margin must be built on a preparedness for real surprise, a responsiveness that stretches well beyond "normal" expectations, and that the responsiveness is endurable and sustainable, without risk of immediate exhaustion of resources. This may imply that adaptation result in functioning beyond the defined space of maneuver defined by rules.
  - o New brittleness(es) or conditions impairing resilient capabilities, will continually emerge, the system characteristics are in motion[13]
    - ▪ Hence, the "divide" between the "go-nogo" spaces to maneuver and the potential exhaustion of resilient capabilities per se, must thus be continually re[14]-assessed
- The issue of *escalation* when approaching the boundaries is therefore a key training principle
  - o The ability to "probe[15]" the proximity to underlying complexity must be a key TORC constituent.

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[11] E.g., Woods, 2015

[12] The TORC rationale includes the acknowledgement of resilience as a fallible practice; adaptive traps must thus be addressed in training, and be related to a managerial mandate that encompasses ambitions as well as boundaries, and adequate support.

[13] "The act of playing the game has a way of changing the rules" (Grøtan 2015)

[14] The divide cannot only be assessed from a distance, it must also be judged on the basis of tangible experience

Moreover, the training progression will also imply a premise of a dynamically changing *orientation* underlying the resilient functioning. As indicated in Figure 6:

- The initial orientation of TORC training is the need for *explication* of the adaptive practices that are within reach related to the less demanding situations; that is, to reinforce and develop practices that are already present in terms of rudimentary resilience
- The second orientation (by implication of experiencing ambiguity) is *interpretation* in the sense of discovery of something or someway that is already present as an (at least retrospectively) acknowledgeable option.
- The third orientation *(*by implication of experiencing equivocality) is *sensemaking* as the springboard for (novel) action.
    - As put by Brown et al. (2015), the difference between *interpretation* and *sensemaking* is that the latter is less about discovery than *invention.* I.e., sensemaking refers to processes by which "people generate what they interpret" (Weick, 1995, p13). Interpretation and sensemaking are overlapping processes, hence the phrase 'equivocality reduction' signifies the ultimate orientation because it readily acknowledges that *both* discovery *and* invention are aspects of sensemaking (as put by Brown et al., 2015, page 267) .
    - For both interpretation and sensemaking, *abductive thinking*[16] is an associated trait that TORC training seek to stimulate:
        - The ability to comprehend details and/or "outliers" from new angles ("does it mean something else?"), and to re-direct future (organizational) attention according to the prospect that this may envisage new insight in the future, inducing a change of mindset ultimately influencing the course of action and response.
        - Abductive thinking must however be enveloped by a managerial pragmatic that is able not only to consider new patterns and possibilities as relevant or adequate, but not at least to be able to modify demarcation lines, responsibilities and accountabilities in the organization, or to change strategies and provide additional resources.[17]
        - Abductive thinking can be stimulated by carefully introducing *meaningful* theoretical concepts that create or resonate with cultural traits. What does the organization *seek*[18]?
- Ultimately, when time and circumstance allow neither interpretation nor sensemaking, the last resort for stability-focused intervention is sheer *improvisation*; to (first) act, sense and then respond further.

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[15] "Probing" is notion that implies "touching" a system beyond sheer analysis, preparation and "off-line" rehearsal

[16] The ability to ask and search for alternative meaning and comprehension of "facts" and observations. This applies both for making sense of those that are obviously irregular, but also for being able to see an alternative or "new" meaning in those that are more easily and habitually recognized and comprehended through the prevalent frames of interpretation. See, e.g., Grøtan (2015) for more elaborate references

[17] That is, related to those that are "known" as inherent options of interpretation as well as (the more demanding case of) those that are "invented" as part of sensemaking processes.

[18] E.g., An oil company uses a notion of "hunting risks". This can be elaborated into "hunting brittleness", or "hunting graceful resilient episodes"

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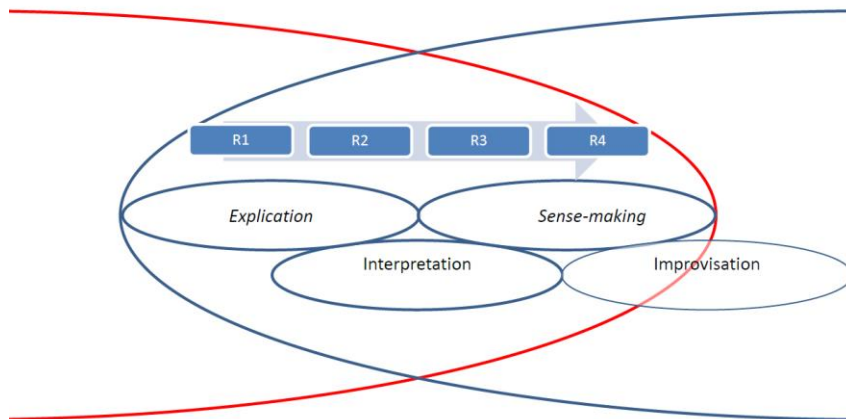SINTEF A27034

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Fig.6.Underlying orientations for R1-R4

The progressive "scale" of underlying orientations fueled by abductive thinking in Fig. 6 is also commensurate with a deliberate process of *anomalizing* (Barton, Sutcliffe, Vogus and DeWitt, 2015), in which *contextualized*[19] practices fuel performance by enabling teams and organizations to discern, interpret and make sense of important discrepancies as situations unfold, and thus develop a richer understanding of a situation (what Barton et al. denote proactive leader sensemaking). An example of *lack of managerial contextualization,* supporting such an *anomalizing* process at the operational level, could be the tragic space shuttle accidents, in which doubts and "hunches" that could not be supported by "hard" engineering data, were not pursued or taken seriously by NASA management (Boin and van Eeten, 2013).

1.3.1 TORC training and learning

Learning is one of the four cornerstones of resilience (Hollnagel, 2009b).

The TORC approach however discriminates between three[20] *types of learning* and reflection.

- *Rule-centric learning*: translating adaptive experiences into rules, procedures or protocols that enhance the chances of coping with similar events at a future occasion
- *Adaptation-centric learning*: preserving key features of adaptive experiences in ways that enhance the chances of success at a future surprise.
- *Reconciliation-centric learning*: improving the understanding of the CvR balance, and learning to identify reconciliations that provide a good climate for responsible trade-offs.

A cumulative learning effect of a back/forth movement along the TORC scale of training can be expected. However, a modest warning must be issued; a "stretched system" is constantly evolving. The major divide of the stretched system per se is therefore also in motion, and specific learning (of all three types above) of a specific system may therefore be obsoleted over time . Hence, a key aspect of "learning to learn" in the TORC context is also to appreciate that something might have to be "de-learned" or "re-learned".

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[19] Their attention to differentiations of context is seen as consistent with the CvR foundation of TORC (that is, the CvR foundation is a *possible* contextualization)
[20] See also Fig. 1

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Narratives are seen as important as containers[21] of experiences. They may be "purified" (into rule-centric or adaptation-centric), but they are not at least potentially useful for representing the combined and reconciled, including the managerial influence and facilitation.

The generation of repositories of experience (see Fig.7) is therefore an important part of intra- as well as inter-organizational utilization of the TORC approach.
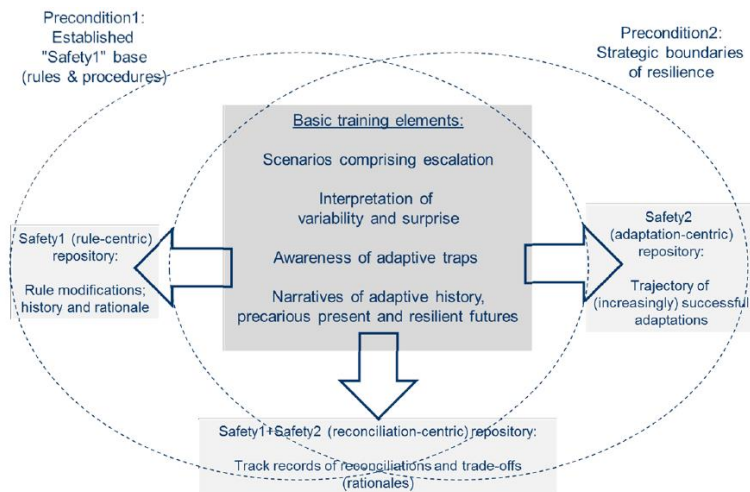
Fig.7. TORC Repositories

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[21] Or at least; skeletons or preservatives that maintain experiences that can be significant for future explication, interpretation or sensemaking not only at a cognitive level, but also in a linguistic or discursive perspective (Brown et al., 2015)

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1.4 Key issues for a TORC-based training program

The overall framing of a TORC training program is indicated in Fig.8. That is, constituting a proper capability of functioning resiliently on a scale from R1 to R4, and at the same time developing the ability of identifying and assessing viable CvR reconciliations. That is, neither "strict compliance" nor "utter resilience" is of practical interest. The overlapping (hyperbolic) zone is the focus of TORC, in which training enables the organization to increase its relative weight of resilient capabilities.
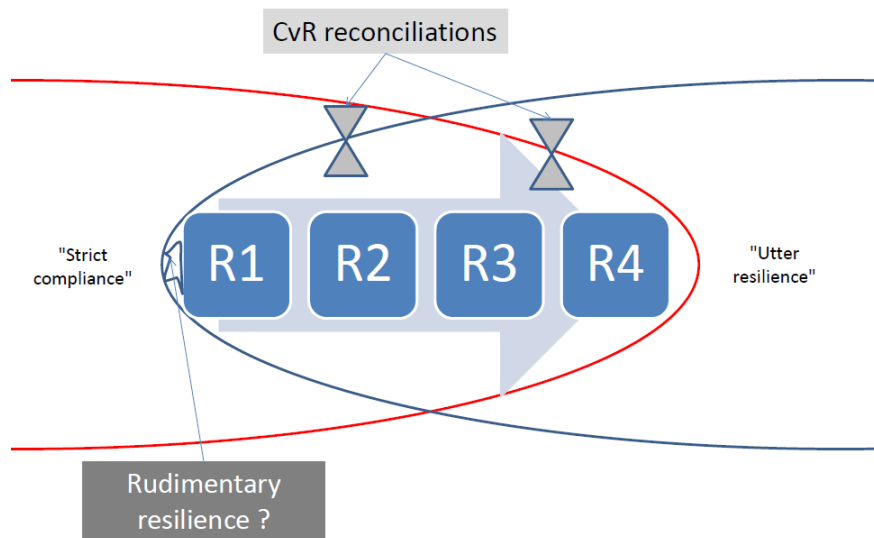

Fig.8. TORC objective; point of departure, progression through training

The aim and aspiration of (progression through) TORC training is thus a gradual and stepwise capability building process, in which:

1. "Strict compliance", the stance and belief that well-defined procedures constitute a self-sustained safe envelope per se, is a recognizable and familiar *idealization*
2. Operational experience is brought to the fore to legitimate the need for behavior beyond (strict) compliance. This can be translated into a presumption of *rudimentary resilience*, that subsequently may be characterized/assessed along the R1-R4 scale
3. The overall aim is to include resilient functioning (R1-R4) in procedural training gradually, *ultimately* into the (idealized) end-point of "utter resilience" that is not reliant on procedures at all (e.g., in terms of improvisation, individually or as co-creation between people cooperating)
4. The "mixed CvR zone" is however of most practical interest, encompassing a *changing imperative* of
   a. recognising and valuing resilient contributions to compliance
   b. recognising and valuing the compliance foundation of resilience
   c. optimizing (resilience) reliance on prescriptions
   d. facilitating resilient responses
   e. continuous reflection on resilience in action
5. Hence, with increasing **CvR ratio** (from left to right in Fig.8), the situated CvR reconciliations will reflect a **change of primacy**

   a. Rule-centric reconciliation: how does resilience support compliance?

   b. *Adaptation centric reconciliation: how do procedures provide a resource for resilience?*

Finally, the law of stretched systems (Woods 2014, Woods and Hollnagel 2006) will always be kept in mind. That is, a learned resilient capability resulting in a specific way of resilient preparedness may in itself have to be adjusted and "re-learned" as time progresses, and as new demand will require further development of capabilities. Such a development is not an indication of a setback, but indication of *growth*, of organizational adaptation and resilience in the long run.

1.5 Application of the TORC concept

These application areas are assumed:

1. Training increasing resilience in normal operation (in which the "compliance context" is given by the safety management system and defined procedures)
2. Emergency Preparedness (in which Defined Situations of Hazard and Accident (DSHA) together with emergency plans form the "compliance context")
3. Unexpected/surprise situations (in which the "compliance context" must be identified "on the spot" as part of the training)
4. Combined scenarios – escalation (e.g. the junction from "normal R2/R3" to "emergency R1")

The common focus for these applications areas is the resilient capabilities an organization should prepare, both at the sharp and blunt ends, in order to be aware of and be able to encounter the (un)expected, and to cope with it by engaging all enablers and cooperators to respond adequately. The implication is that both sharp end and blunt end actors need to co-create and perform within a mandated space of manoeuver although this mandate may be challenged when adaptations require so. Communication therefore is a prerequisite for successful adaptations.

2 TORC Training Objectives

TORC discriminates between three types of training. The objectives of *operational*, *managerial* and *integrated* training are distinctive and diverse, but mutually coherent in relation to the TORC rationale.
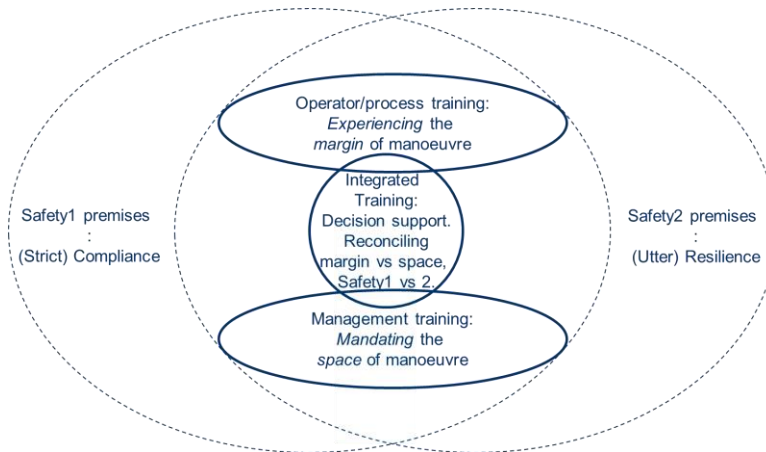

Fig.9. Distinct TORC training objectives

2.1 Main objectives

The main objective for **operational** training is to experience, bring forward and articulate the necessary *margin of manoeuver* in terms of the R1-R4 scale, in a way that engages and documents the necessary underlying orientations and mechanisms.

The main objective for **managerial** training is to assess, articulate and communicate a mandated and legitimate *space of manoeuver* in terms of the R1-R4 scale, in a way that establishes a sound balance between the validated/anticipated operational capabilities and the surrounding technical safety and risk picture, and that also is accompanied by a clear managerial strategy to support the operational orientations that are necessary by implication[22].

The main objective for **integrated** training is to create awareness of, elicit and spark dialogue on the potential gap between WAI and WAD, and thus to ensure that the chosen reconciliation of *margin vs space* of manoeuver is founded on a proper balance of the WAI/WAD opposition (see Figure 10). As a result, both operational staff and management mutually balance their strategies, define the need for appropriate resources and apply and adapt them accordingly.

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[22] E.g., if "space" is assigned at R3, management must have a corresponding strategy to support different forms of "anomalizing" at the operational level; either interpretation of options, or sensemaking when options are not predetermined. Those two cases will imply different *managerial contextualizations* according to the vocabulary of Barton et al. (2015)
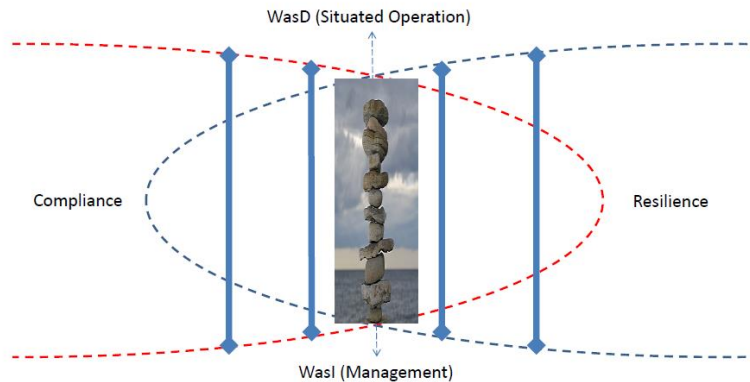
Fig. 10 Integrated training objective

2.2 Sub-objectives (preliminary)

The following sub-objectives for TORC training can be derived from the main objectives:

Table 1, List of sub-objectives

O-ID	Description	Relevance		
		O[23]	M[24]	I[25]
1	Sensitivity to the WAI/WAD opposition	X	X	X
2	Sensitivity to "decisive moments" that spark a process of anomalization by successively building on shifting orientations (explication, interpretation and sensemaking) (common denominator: abductive thinking)	X	X	X
3	Ability to actively support and contextualise the anomalization process		X	X
4	Ability to display "adaptive intention" to surroundings and collaborators	X		X
5	Sensitivity to adaptive traps	X	X	X
6	Framing of local/situated "rudimentary resilience"	X	X	X
7	Ability to deal with the changing imperatives, change of primacy, of increasing CvR ratio	X		X
8	Ability to deal with the non-linear development of "graded" resilience R1-R4	X		X
9	Ability to attend to the (dynamic) divide implied by the Law of Stretched systems (Woods 2010, Woods and Hollnagel 2006)		X	
10	Ability to recognise need and advance on a scale of resilience	X		X
11	Ability to expand adaptive behaviour outside own context (deepen the response by adapting strategy and deployment of additional resources)		X	
12	Ability to discriminate between and deal with rule-centric, adaptation-centric and reconciliation-centric learning	X	X	X
13	Ability to generate (different) learning repositories (that is, knowledge, experiences)	X	X	
14	Ability to utilise learning repositories in real situations	X	X	X

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[23] Relevant for *operational* TORC training
[24] Relevant for *managerial* TORC training
[25] Relevant for *integrated* TORC training

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15	Ability to map resilience scale to a technical safety envelope	X	X	X
16	Ensuring and enacting the ability to give and to moderate feedback on resilience experience at sharp end by field staff	X	X	X
17	Ensuring the ability to analyse feedback through after action review to signal and trigger necessary adaptations at organizational level (CvR reconciliations).		X	X
18	Ability to modify demarcations, accountabilities and responsibilities as a result of (new) CvR reconciliations		X	

3 TORC Training Structure

As indicated in Fig. 11, the TORC *Training Structure* comprises the notions of Training Targets (TT), Training Elements (TE), Training Formats (TF) and Training Strategies (TS). This structure is chosen as a generic structure not only to assist in the design of a specific training but also enable to plan a training program depending on the context of training.

Specific resilient capabilities accomplished by training will partly be dependent of the context were they are expected to function as part of company development, on-going training program, preconditions and company culture.
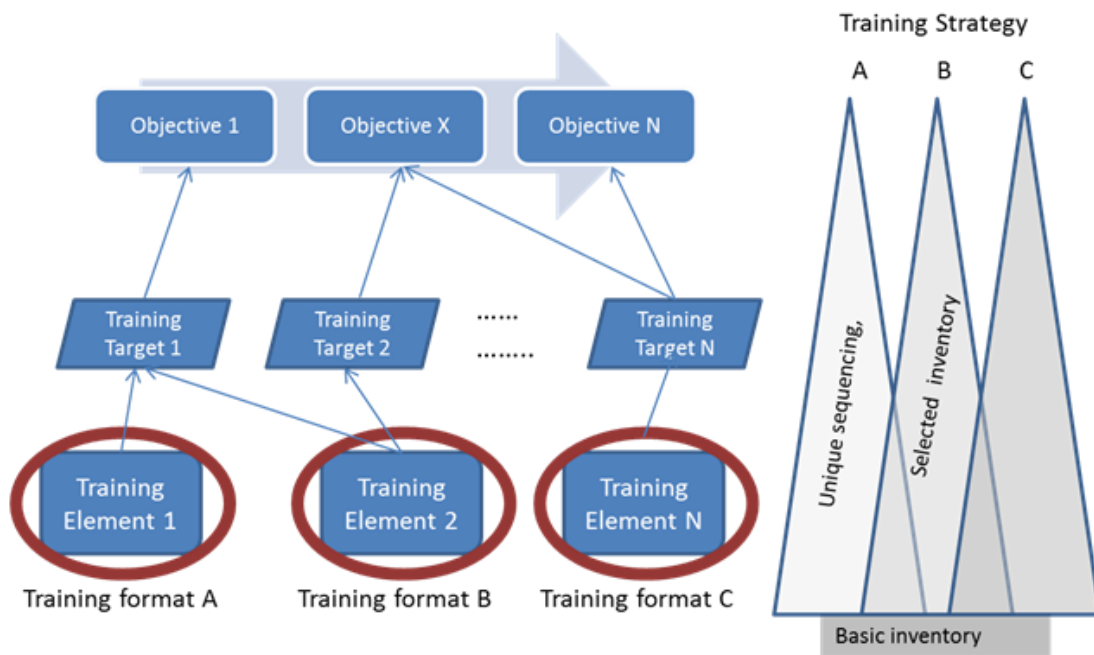
Fig.11. TORC Training Structure

In Fig. 11, the (generic) Training Targets (TT) are operationalizations of the TORC sub-objectives, articulated for practical training purposes. An arrow from a TT to one or more (sub)objectives thus signify such an operationalization.

A Training Element (TE) is a unit of distinct training activity aiming at one or more TTs. An arrow from a TE to an TT thus signifies such an association. The TE may thus be regarded as a further operationalization of one or more TTs, in a repeatable way.

A Training Format (TF) is a specific way of conducting a TE (e.g. by off-line training, on the job, gaming etc.)

Specific Training Elements (TE) and Training Formats (TF) constitute generic entities for implementing specific TTs in a manner that can be re-used across companies.

A Training Strategy (TS) is a set of TEs (and TFs) that is arranged and conducted for the purpose of a specific organization, its needs and preconditions.

Hence, connected Training Strategies (TS) can be built from common objectives, shared TTs and generic TEs/TFs, based on a 'basic/minimum inventory'.

Activities in TORC WP2, 3 and 4 are seen as Trainings Strategy *pilots,* both building *and* building *on* a shared repository of TTs and TEs.

In WP1.2 of TORC we will document the shared repository of generic TEs.

In WP1.3 of TORC we will develop a guideline on how to make a subset of these objectives, TT and TE/TF as a part of the "priming" for a TORC training program.

Hence, in WP2, WP3 and WP4, the actual piloting stories, the actual conditions and chosen strategies are being developed as part of a stepwise approach departing form case based preconditions, needs and ambitions to develop resilient capabilities.

4   TORC Training Targets

4.1 List of Training Targets (preliminary)

The following TTs for TORC training are identified at this stage of the TORC development process:

Table 2, List of Training Targets

O-ID	TT-ID	Description	Relevance (TBA)		
			O [26]	M [27]	I [28]
		Understand and learn to be aware of situations, upcoming demands and the possibility that work planning may not be sufficient to deal with unforeseen operational demands. Ref. Figure 1			
		Understand and learn to be aware of changing operational situation and acknowledge and explicate the need to change the current work strategy and to organise relevant communication with regards to necessary changes in work and governance.			
		Understand and learn to organize decision making and cooperate with relevant stakeholders, "contextualizers", decision makers or providers of resources to gain a richer understanding of the situation, adapt the work strategy and prepare alternative for action			
		Learn to understand unwanted outcomes of consecutive adaptations and anticipating potential crossing safety boundaries without being in control.			
		Understand and learn to be aware of and to be able to address resources in individuals, team and organizations - knowing the need for and requiring the mandate for space of manoeuvre and the complementary resources to adapt.			

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[26] Relevant for *operational* TORC training
[27] Relevant for *managerial* TORC training
[28] Relevant for *integrated* TORC training

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Understand and learn to be aware of resilience capabilities and *potential* in order to: 1) ensure that the basic need to be able to adapt work practices is understood, facilitated and prepared 2) set the targets to have them grown and trained towards a defined level, based on the anticipation of the *future* need for capabilities, 3) enable the organization to learn from experience and to evaluate (patterns of) resilience of situated cases and series of cases over time. Primary target group: management and first line supervisors		
Understand and learn to be aware of resilience capabilities and to choose the proper mix of resilience "grades/levels" to manage the deployment of resources and act resilient at individual, team and organizational level according to situational needs and dynamics.		
Understand and learn to know and manage the space of manoeuvre close to or beyond safety boundaries being defined by company compliance regulations or allowed by specific predefined mandates by management and permitted adaptive behaviour, herein: • Awareness of boundaries: what boundaries exist (dynamic and shifting boundaries)? • Continued re-assessment of boundaries • Define the 'safe operational envelope'		
Understand and learn to reflect on experience with adaptive practices, elicit dilemma's encountered, learn from explicit successful or non successful behaviour for remembering strategies applied and using it for direct follow up and in future work (resilience repository).		
Learn to understand lesson's learned from adaptive practices and to analyse findings in terms of what experiences and reflections need to be communicated, to lead to proposals for adaptations at the company level (e.g. change strategies, rules/SOP-'s, develop training etc.).		
(Initial) Knowledge and experience of the CvR opposition a) Rules and procedures b) Rule centric resilience: How does resilience support compliance? c) Adaptation centric: How do procedures provide a resource for resilience?		
Understanding the properties of resilience in the organization a) CSF[29]1: Risk awareness consists of Risk understanding, Anticipation and Attention b) CSF2: Response Capacity consists of Response, Robustness and Resourcefulness/Rapidity c) CSF3: Support consists of Decision support and Redundancy d) Combination of CSF1, 2 and 3 e) Other resilience attributes in the organization (e.g. learning, monitoring)		
Understanding trade-offs and goal conflicts		

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[29] "CSF" denotes "Contributing Success Factors" (Størseth et al. 2010). Will be presented in chapter 6.1.2

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5   Typology of Training Elements (TE)

The typology of Training Elements comprise a combination of knowledge exchange, dialogue and experience at an individual as well as collective level. TEs may be supported by training aids that can be be used as job aids as well.

Basic Training Elements identified at this stage of the TORC development are:
- Task preparation (readiness and sustainability)
- Being aware and understand risks, vulnerabilities and the unexpected
- Recognition of boundaries
- Information sharing
- Collaboration and interlinking functions
- Communication (team and network, bottom up and top down)
- Assessment check of information available and impact of actions envisaged
- Awareness and allocation of resources
- Decision support (in escalating situations, solving dilemma's)
- Decision making and action
- Monitoring effects
- (Re)actions

Additional training elements are aimed at learning in a broad sense:
- Resilient strategies
- Reflection on action
- Engaging in evaluation of dilemma's encountered in CvR reconciliation
- Explicating experience in terms of findings leading to proposals to strengthen resilient capabilities at the organisational level.

6 Drafting of Resilience Capabilities; "a la TORC"

The intention behind the TORC Capability Concept is to provide a means to preserve learned capabilities, and to establish a measure for the impact and effect of TORC training.

As a key TORC presumption is that resilience may/will manifest episodically, it is important that the capability concept is suitable for describing episodes (their initiation, path, extent, termination). This also enables a more focussed and coordinated training activity founded on (repeatable and replicable) Training Elements with common rationales and objectives.

The following is an *outline of some possible constituents and building blocks* for the TORC Capability Concept. A further selection as well as alignment of terms and premises will be conducted in the further TORC development process. Hence, inconsistencies and variations in vocabulary will appear in this chapter, in the present version of the document.

6.1 Overall capability

The notion of "Capabilities" is chosen as a concept to signify the TORC ambition of building up an array of abilities and capacities to act in a concerted manner that can be described as resilient (providing organizational and/or team resilience).
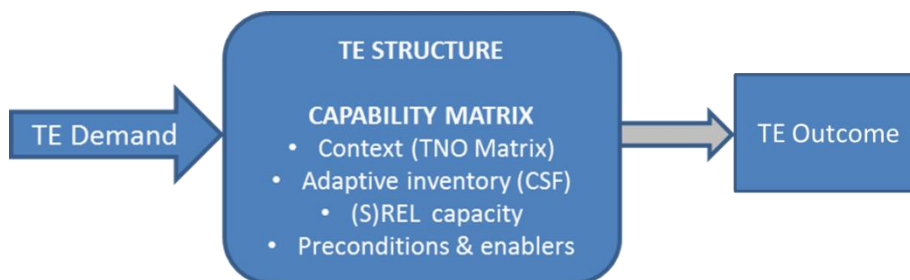

Fig.12. TORC Capability Matrix and TE Structure

The notion of "capabilities" is widely used and has different meanings in a wide variety of contexts. For TORC, the notion is founded on a capability matrix that incorporates the combination of (Fig. 12):

1. A context identifying organizational level(s), teams, roles etc. as resources for facilitating resilience adaptations
2. An (adaptive) inventory of adaptive/resilient components across levels and contexts (that is, in the pragmatic context which is trained)
3. A capacity to respond through interaction and mobilization (of abilities in terms of components) across individuals, teams and organizational boundaries and bodies, in order to leverage the necessary response that fulfils resilient operation without exhaustion, hesitation or abortion.
4. Preconditions and enablers: base abilities (competencies, skills and individual resources) that are (necessary, but not sufficient) prerequisites for resilience

A Training Element (TE) may thus be designed to invoke, reinforce or build an intended capability founded on the capability matrix. That is, the TE structure must convey not only a defined demand that involves (parts of) a presumed capability matrix, but also specify the expected outcome in terms of, e.g. a validation of an assumed ability to deal with a situation, or the build-up and solidification of certain parts of the capability matrix.

A capability can be layered to signify various "maturity levels" that can be associated with a stepwise ambition/aspiration level, as implicated in Fig. 5, 6, 8). The building of a capability leads inherently to shifting competence envelopes by learning and adaptations as result of successful actions.

Based on this combination TORC has a working definition on resilience capability being:

A resilience capability is the ability to perform or achieve certain actions or outcomes through a set of controllable and measurable components (faculties, features, functions, processes, or services) encompassing:

- *competences*
- *resources and*
- *a strategy*

to enable a sustainable adaptive <u>*response*</u> *to* <u>*demands*</u> *due to e.g. disturbances, disruptions and change. Components of a capability can be found at individual, team and organizational levels.*

Competences are clusters of knowledge, skills and attitudes which are necessary to perform tasks, solving problems, and more generally to execute a job, a function or a certain role.

Resources are sources of knowledge, technological or organizational facilities and structures available or to be deployed to support resilient activities.

Strategies are inherent or prepared mental concepts to be applied to guide informal and formal decision making and direct the adaptation process. A strategy may be learned or improvised.

6.1.1 Capability context

The implementation of a capability requires some basic resources being a decision and communication structure or network, and access to appropriate resources.

Figure 13 illustrates the overall framing of the TORC Capability; base abilities/resources may be found at various levels (from individual to community), while a key resilience measure is also whether these can be mobilized for successful outcome "on demand".
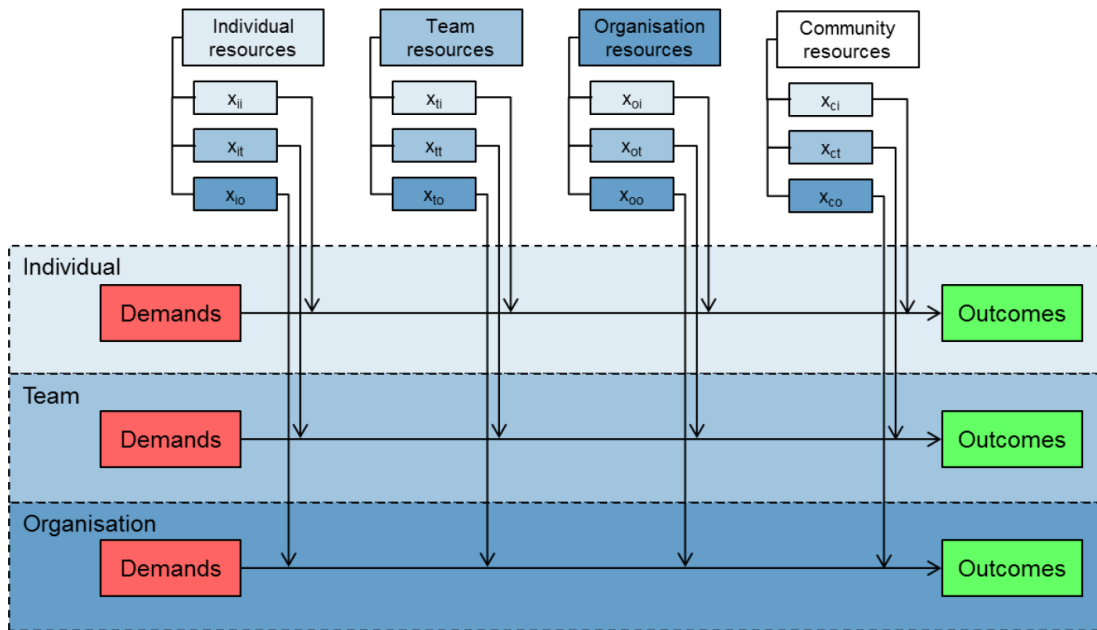
Fig.13. Framing of Multi Level Resilience Capability (© TNO, Kamphuis et al)

6.1.2 Compact representations of the "resilience inventory"

The resilience inventory can also be represented by a more generic and compact set or *inventory* of resilience attributes that may be instantiated and combined at different levels, allowing more precise and concentrated focus on the instances relevant for the specific occasion/episode.

One candidate for such an inventory is the Contributing Success Factors (CSF) (Størseth et al., 2010) approach, as indicated in Fig.14.
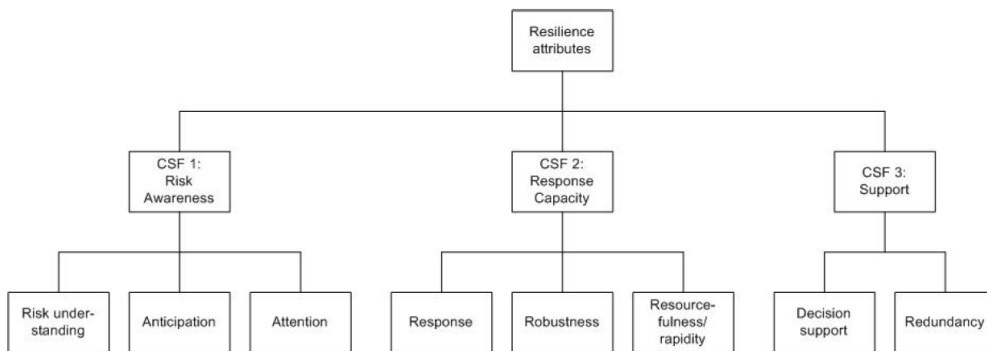

Fig.14. Contributing Success Factors (Størseth et al., 2010)

The CSF approach may also be used, e.g. by the REWI (Øien et al., 2012) method, to monitor the base abilities.

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Another generic candidate is (of course) Erik Hollnagel's (2009b) renowned four cornerstones of resilience, in which *monitoring* and *learning* is also emphasised.

However, a key criterion for selection of inventory structure is that it must be possible to expand the inventory in a manner that covers the full scale as depicted in Fig.13.

6.1.3 Capability Dynamics: Capacity to interact

The dynamic dimension[30] of the TORC Capability is the capacity to respond with a spontaneous or trained adaption or coping strategy through interaction and mobilization (of compenents/abilities) across individuals, teams and organizational boundaries and bodies, in order to enable the necessary leverage of performance, and to execute resilient operation persistently without exhaustion, hesitation or abortion.

This can be paraphrased as an "enabling communication structure", "making resources meet, on demand", in a cross-scale flow, incorporating both operational and managerial actors by connecting the blunt and sharp end in an effective (ad hoc) network, as illustrated in Fig.15.
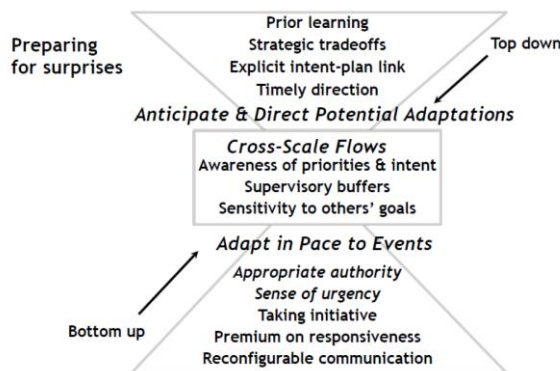

Fig.15. "Rendezvous": when resources are implemented

Such a capacity may take the form of a generic heuristic, protocol, strategy, but it is also in the ultimate (R3/R4) sense a capacity to respond/organize more spontaneously, and that initiative/leverage of a response is not reliant on a prefixed strategy.

E.g., when field staff needs to cope with upcoming demands they implement their capability to maneuver and to prepare for a shift to another practice/solution to implement alternative/complementary actions. At that moment they need to implement a resilient response leading to deployment of resources at individual, team and organizational level. The sharp and blunt meet and engage in a cooperation for adaptation. By doing so the actual dynamic/anatomy of this "rendezvous" (Fig. 15) can be modeled as an *adaptive real time momentum* (the warm site of resilience) comprising several (cap)abilities across individual, team, organizational and community levels.

The Response-Execution-Leverage (REL) Model (Grøtan, 2015) depicted in Fig. 16 is a model of such *rendezvouses* in terms of *adaptive clusters* based on the generic resilient attribute inventory denoted Contributing Success Factors (CSF) by Størseth et al (2010). Hence, the CSFs provide an important a priori

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[30] Denoted "(S)REL capacity" in Fig. 12

collection of abilities prepared to be deployed when required, however without "locking" them to any specific level. The REL method uses the same set of CSF attributes in a *dynamical* context, in which *formations* of (sub-sets of) CSF attributes[31] constitutes the *adaptive clusters* (AC) that are leveraged episodically. Hence, it directly supports (e.g.) the required *premium on responsiveness* and the *focus on initiative (leverage)* as stated in Fig. 15.
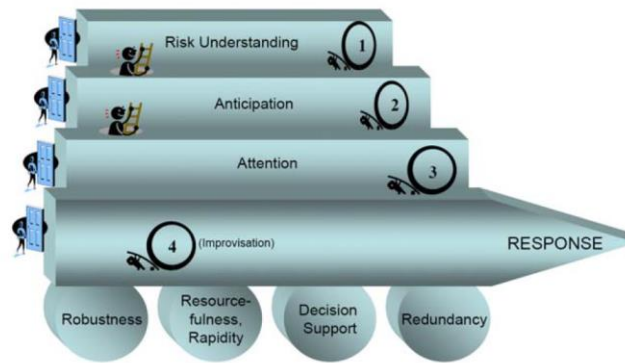

Fig.16. The Response-Execution-Leverage (REL) Model of Adaptive Clusters

The REL model is thus a resource to describe how adaptive clusters (AC) manifest in resilient episodes, and it can also be used to design training elements on similar grounds.

The REL model may be further extended (Grøtan, 2015) into a *Stratified REL* (SREL) model in which the adaptive formations/clusters not only cross organizational boundaries, but also engage the inherent "prescription vs practice" dialectic[32] between, e.g., the managerial and the operational spheres in an organization. This will be important for the purpose of projecting an AC into a CvR reconciliation, as well as for understanding and supporting the active contextualization needed for an effective (TORC-based) *anomalization* process (ref. Fig. 6, and Barton et al., 2015).

Fig. 17 illustrates that ACs can take place at different levels (and lengths) in the CvR "mixed zone", and that the "compliance support" can be more or less explicit (e.g., a response in terms of an act of providing "resourcefulness" to another actor, can be rule-based per se)

Moreover, as any adaptive behavior of a single unit within an AC may inflict a potential misinterpretation from other agents/units, the *communication of change* in intentions, rule-violations etc, is an essential part of any TORC Capability dynamic.

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[31] Components of resilience
[32] See Nathanael and Marmaras (2008).

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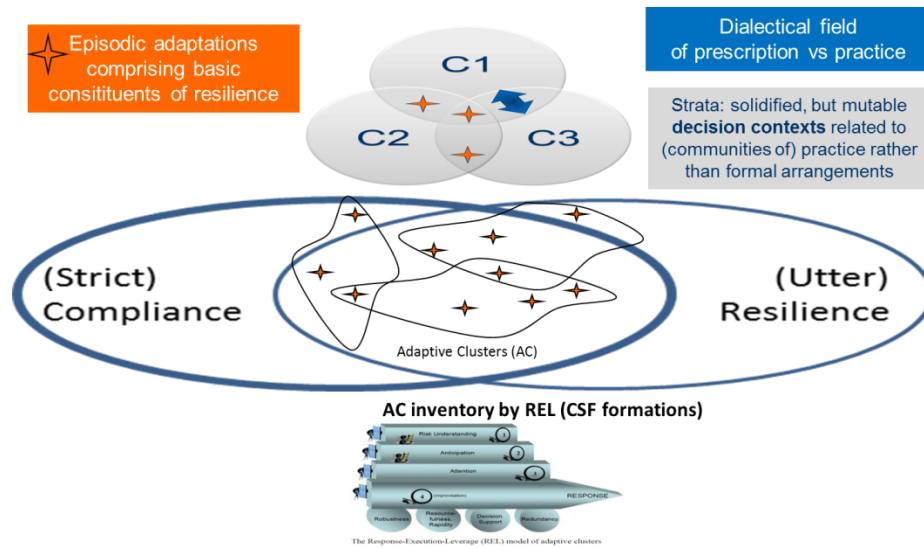SINTEF A27034

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Fig.17. Adaptive clusters in different shapes in the (stratified) CvR space

6.1.4 Preconditions and enablers

This part of the Capability structure comprises various skills, competencies and resources that are considered necessary to enable the operation of a specific capability.

One example of such an enabler with implications beyond the team in a narrow sense is Weick's (2009) notion of "positive organizing" in terms of

- Respectful interaction
  - Trust the reports, be a trustworthy observer, maintain self-respect
- Heedful interrelating
  - 'My work' as a contribution to the system
  - Use of representations that includes the actions of others, and their relations
  - Treat the system as your referent, ask what it needs
- Including Mindful organizing (Weick and Sutcliffe, 2007)
  - A consistent effort to recall detail
  - Spend time examining error as a window to the health of the system
  - Preoccupation with (the possibility for) failure (rather than sucess)
    - Success breeds complacency; need to be wary of success
    - Hunt for lapses and errors, as they may be precursors of something larger
  - Reluctance to simplify
    - Simplification is necessary but inherently dangerous
    - Simplify less and see more
  - Sensitivity to operations
    - As aware as possible of the current state of operations
  - Commitment to *resilience*
    - Don't let errors disable you!
    - A commitment to learn from error
  - Deference to expertise
    - In high tempo; decisions 'migrate' (downwards) to the expertise
    - Return in normal circumstances

6.2 Capability levels

Resilient capability levels will therefore be differentiated as identified in chapter 1.2.2:

- *R1*. **Defend** normalcy (preferred mode of operation)
- *R2*. **Build** robustness to anticipated disturbance
- *R3*. **Stretch** and rebound in an (isolated) surprising situation/episode
- *R4*. **Sustain** resilient functioning over time

Table 3 hints at some possible signifiers/indicators of the incremental change in resilience capabilities.

Table 3, Signifiers of incremental change in resilience capabilities

	R1	R2	R3	R4
Key word	Watchfulness. Responsibility (every action counts). Able to admit mistakes. Open for being corrected. Courage to challenge. Appreciate the WAI/WAD distinction.	Readiness to respond. Make fewer assumptions. Ignore less. Anticipation. Notice more Curiosity. Awareness.	Sensemaking. Prepared to be surprised. Look beyond the obvious. Spot emerging patterns early. Alert and ready to adapt. "Hunt risks"	Improvisation. Mutually supportive.

However, a capability level will not be just a matter of inventory of abilities, it must also reflect a type of assurance that the trainee is able to mobilize all the necessary abilities. E.g., the mobilization of "R4" will be much more extensive than the mobilization of "R1". Moreover, any capability level will intrinsically require a corresponding maturity with respect to CvR reconciliations.

6.3 Evolution of capabilities

The process of CvR reconciliation involves an interplay with several actors involved both in "warm" as well as "cold" situations. The sharp and blunt ends cooperate and work bottom up and top down, as indicated in Figure 18. First, this is done by co-creating their adaptive response to demands. Second, by reflecting on it several moments after the mission, task or job has been concluded in a way leading to eliciting implicit/explicit considerations as well as formal/informal behavior. Interpreting and making sense of this e.g. by story telling and organized after action review leads to new insight in whether the adaptations need to be remembered as successful or not. Third, the conclusions from these experience may lead to learning and to adaptation of resilience and compliance strategies.
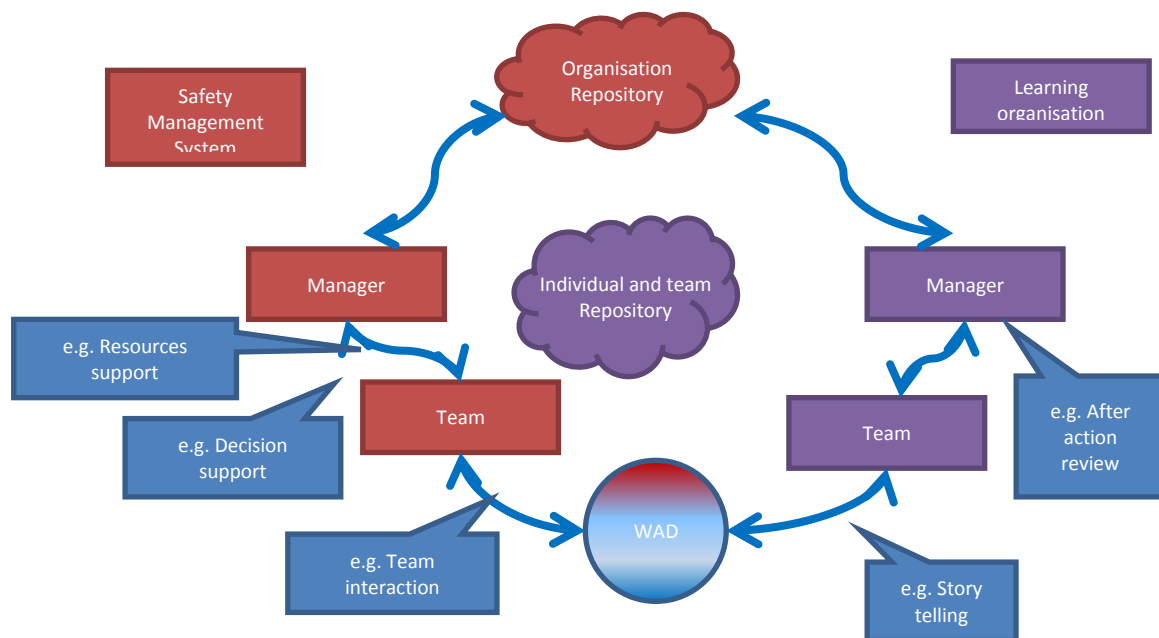

Fig.18. work as done supported by interaction of field staff/operators and management

Resilience thus has "warm" and a "cold" side; appreciation of resilience in action (WAD) and reflections on resilience *potentially* lead to sustainable organizational adaptations (that is, changing also the WAI). Possible perspectives of the reflection on resilience action are for example to:

- make dilemmas encountered transparent and open for discussion, create awareness of underlying assumptions
- renew and change rules leading to more goal oriented rule, leaving space for adaptation based on interplay of actors and their craftsmanship
- design and implement new training to improve competences in order to be better prepared for future adaptive activities (shifting competence envelopes)
- develop better communication structure to enable decision support.

Resilience dynamics at the warm side may include shifting competence envelopes in short and fast interactions between sharp and blunt ends, e.g., in crisis management leading to temporary adaptations through adaptation of strategy and a call and deployment of complementary resources. Resilience dynamics at the cold site will follow a slower time path and allow for organisational adaptations in the longer term.

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