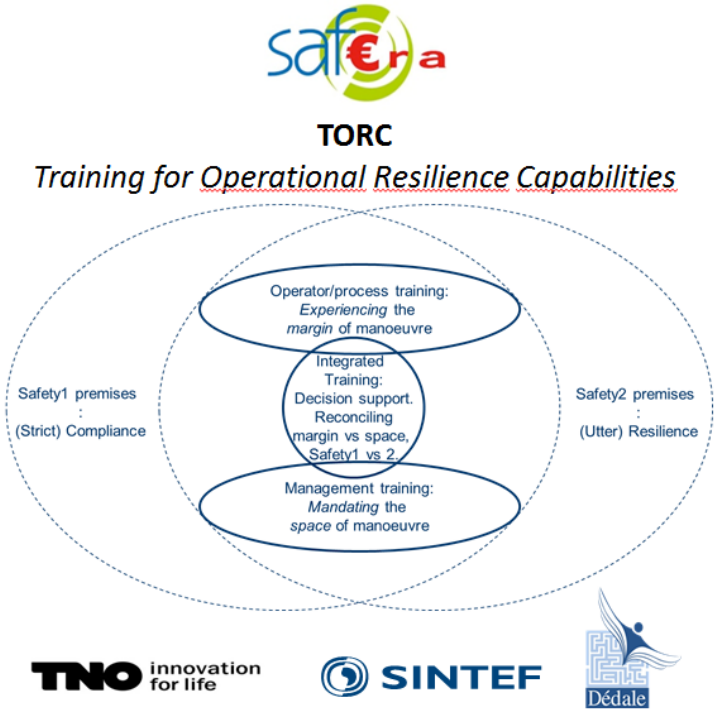
Report

Training for Operational Resilience Capabilities (TORC): Summary of concept and experiences

TORC project Deliverable D4.1

Author
Tor Olav Grøtan



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AUTHOR
Tor Olav Grøtan

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ABSTRACT
TORC positions resilience in the context of its opposite orientation: compliance. Results from piloting, encompassing more than 1.000 trainees per ultimo 2016, indicate that the TORC approach is broadly recognised as a pragmatic way of approaching the resilience concept in the industrial contexts of railway construction and maintenance, on- and offshore petroleum production, as well as air traffic control. This report, denoted TORC project deliverable D1.4, revises and summarises the previously described D1.1 (1st Concept Elaboration) based on experiences from piloting and training. The rationale and foundational concepts related to "Compliance vs Resilience" (CvR) are reviewed, and the TORC training approach is described in terms of a distinct but coherent set of training arenas; operational, managerial and integrated training. TORC training can be applied in different areas of application, e.g., both normal operation and emergency situations. The training arenas share a common foundation in terms of a conceptual but non-normative reference for navigating and manoeuvring in the CvR space. The TORC Board Game operationalizes this foundation and supports all three training arenas, and extensive guidance is available for preparation and implementation of TORC training by gaming. Actual training experience is summarized as perceived added value and needs for improvement. Finally, a prospect for future TORC development is sketched out.

PREPARED BY
Tor Olav Grøtan

SIGNATURE
Tor Olav Grøtan

CHECKED BY
for Irene Wærø

SIGNATURE
Ranveig Kviseth Tinmannsvik

APPROVED BY
Stian Antonsen

SIGNATURE

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1 Training for Operational Resilience Capabilities (TORC): The project

The TORC project has been a European collaboration under the Safera ERA-NET collaboration (call.safera.eu). The project ended in 2016. The key information and results are available at http://www.sintef.no/en/projects/torc-training-for-operational-resilience-capabilit/, on behalf of the TORC consortium of research partners.

The TORC project has been conducted as a joint research project by the TORC Consortium, developing a training concept in collaboration with industrial partners. The TORC concept aims specifically at *resilience as the desired outcome* of training, but positions resilience in the *context* of its opposite orientation: *compliance*. This is denoted the "Compliance vs Resilience" (CvR) perspective, from which trainee organizations are introduced to a process of developing skills, competences, resources and strategies that make them capable of "organizing, thinking and acting *resiliently* under the imperative of compliance" (Grøtan 2015). The responses from the industrial pilots throughout the TORC project have validated that the CvR perspective is broadly recognised as a pragmatic way of approaching the resilience concept in the industrial contexts of railway construction and maintenance, on- and offshore petroleum production, as well as air traffic control.

Through a fruitful collaboration between Consortium research partners SINTEF, TNO and Dédale, and industry partners Strukton Rail, Infraspeed Maintenance BV and Nederlandse Aardolie Maatschappij B.V. (NAM), the theoretical CvR perspective has been operationalised into a training concept founded on a specially designed board game, and an elaborate guidance on preparation and implementation of game-based TORC training. Based on the experiences from piloting activity and feedback from pilot trainee organisations, in sum involving more than 1000 persons in terms of group training sessions by the end of 2016, this report summarises the key concepts, and describes the main feedback and observed yield.

The total TORC documentation (see the link above) constitutes a foundation for autonomous preparation and implementation of TORC training, comprising the following key material:

- TORC D1.1: SINTEF Report A27034 (2015): Training for Operational Resilience Capabilities (TORC): 1st Concept Elaboration.
- TORC D1.2 & D1.3: SINTEF Report A27931 (2016): Guidelines for the preparatory work needed to implement a TORC training program.
- **TORC D1.4**: SINTEF report A28099 (2017): Training for Operational Resilience Capabilities (TORC): Summary of concept and experiences (**this report**)
- TORC D3.1–D3.3: TNO report R11489 (2016): A report summarizing preparation and implementation of the TORC training modules (in Netherlands)
- TORC D5.1: TNO report R10988 (2016). TORC Impact Assessment, Framework, Methodology and Validation Roadmap
- A scientific paper by TORC Consortium members: Using gaming and resilience engineering principles to energize a situated resilience training of front-end operators and managers (Grøtan et al. 2016).
- A Booklet by TNO: Fostering Resilience through Changing Realities. Introduction to operational Resilience Capabilities
- Presentations from the final TORC workshop in Utrecht, NL, December 2016

However, it is recommended to engage skilled support from researchers or consultants in order to gain maximum benefit from TORC training. With proper strategizing in advance, TORC can be part of a strategic foundation for developing organizational resilience beyond the initial scope reflected in this report. The TORC Consortium partners will sustain a mutually supportive effort of facilitating further development of the TORC concept and its use.

2 Rationale and key concepts related to "Compliance vs Resilience" (CvR)

According to the CvR perspective, safety is about being good at avoiding mistakes that it is possible to anticipate and prepare for, while also being able to handle unexpected situations, disturbances and disruptions that will inevitably arise. Dealing with the expected and the unexpected, however, require relatively different organizational abilities. The focus of TORC is how these two abilities can be cultivated and reconciled.

The development of TORC was sparked by the fact that the safety field during the past decade has devoted more and more attention to the concept of "resilience" that can be understood as resistance, hardiness, robustness, endurance and/or adaptability in relation to unexpected events or circumstances, disturbances, stress or shock. This has to a large degree been channelled through the "Resilience Engineering" (RE) approach (see, e.g., Hollnagel et al. 2006, 2009b) which represents an ambition to build resilience in complex systems, inspired by thinking and practices in a variety of fields such as materials science, psychology, cognitive systems, ecology, crisis and disaster management and "community resilience", to name a few.

In the RE literature, the prospect of resilience has however often taken the form of a "Safety I or Safety II" polemic or discourse (e.g., Hollnagel et al. 2013, Hollnagel 2014)). In which, the former (Safety-I) is associated with the traditional procedural approach that seeks to avoid (hazardous) errors and discrepancies through prescribing and controlling function and behaviour, while the latter (Safety-II) conveys resilience with an opposite premise; focusing on the ability to adapt to dynamic circumstances. "Safety I or Safety II" is thus a contrast between an aspiration to minimize errors and discrepancies, and to maximize the number of successful adaptations. It is thus also a contrast between a worldview presuming that a system can be comprehended as a series of stereotypical situations which can be handled instrumentally and prescriptively through imitation, replication and repetition, vs. a worldview acknowledging the existence of emergent and unique situations that demand unique responses from an ultimately "impermanent[1]" organization. In the latter case, also safety per se is an emergent phenomenon. Ultimately, this is also a contrast between the aims of the *absence* of something (e.g., failures), as opposed to supporting the *presence* of something (e.g., adaptation).

The point of departure for TORC is that "Safety I or Safety II", when presented as a dichotomy, is a purely theoretical choice. Laws, regulations and public expectations means that few if any risk-exposed businesses can "opt out Safety I". The pragmatic issue is therefore how we can cultivate resilience and operate more *resiliently*, not only in combination with, but actually from within the "contextual shadow" (Grøtan 2014) of its opposite principle; compliance with rules. The notion of "CvR" signifies this special relation, encompassing aspects of asymmetrical complementarity, dialectical opposition related to basic foundations, and mutual shaping in terms of a continuous quest for reconciliation of rules and adaptive capacities into a functional whole, consistent with the (dynamic) operational conditions and contexts.

Regarding the resilience dimension of CvR, it is crucial to note that the TORC mission is not to introduce something completely new or unprecedented in an organization, served on a platter. Quite contrary, the TORC presumption is that the term "resilience" actually labels and legitimizes something that has always been and must be present in high-risk businesses out of sheer necessity, but most often referred to operate in the (contextual) shadow of the "rational facade" of rule-based safety and compliance. Irrespective of whether such kind of "resilience" is only rudimentary or more consciously developed on its own terms, its merits are likely to remain unappreciated or silenced, in the "contextual shadow" of the prevalent recipient for attribution of successful safety; compliance with rules. These aspects are illustrated in Figure 1.

[1] See Weick (2009)

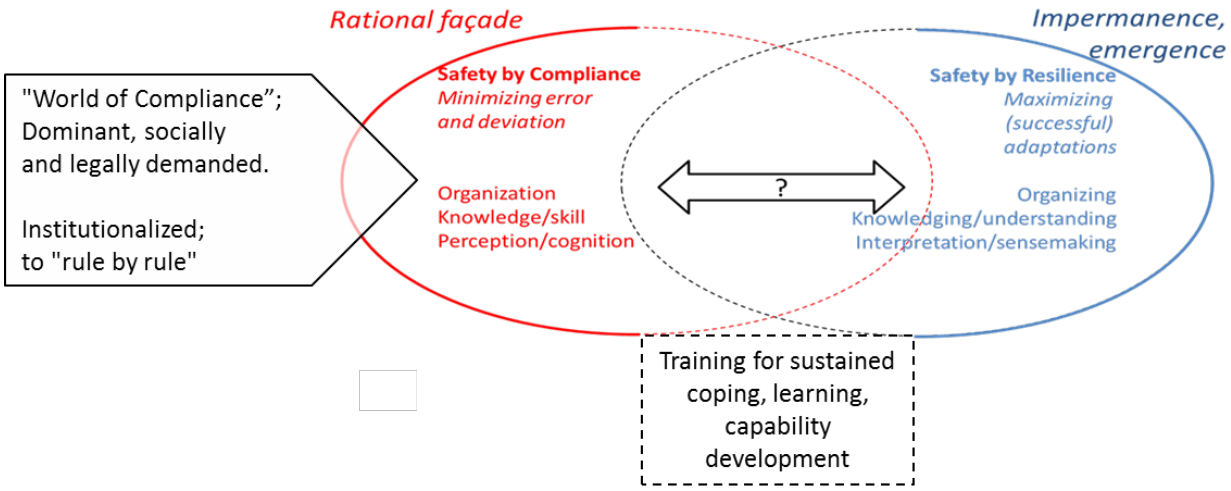

Figure 1 Training in the Compliance vs Resilience (CvR) intersection (based on Grøtan, 2014)

Organizations aiming to engage in TORC training thus should acknowledge the challenge of maneuvering "safely" in the overlap zone between the two principles. That is, they should aim to recognize, implement and develop the principles of resilience in an accountable and prudent manner according to the CvR principle, avoiding any temptation to overestimate resilient properties, and thereby actually increase risk.

Hence, management must take responsibility for setting limits to what is expected and acceptable for "acting resiliently", in a way that reflects the unique operational setting and history of the organization at hand. However, the TORC emphasis on "acting resiliently" rather than "being resilient" does not preclude us from seeking inspiration from the RE literature (see Grøtan et al. 2016).

3 The TORC training approach

3.1 Foundation: operational and managerial training foci in the CvR context

TORC facilitates three distinct but coherent training arenas (operational, managerial and integrated) in a joint CvR context, involving operational staff and/or management. The shared objective is to enable the alignment between the perceived operational need for leeway ("margin of manoeuvre") and the managerial mandate ("space of manoeuvre"). A key aspect is bringing the operational staff and management together in training on the handling of safety dilemmas and borderline situations. The ultimate result sought is a reconciliation in the sense that the managerial mandate corresponds to the perceived operational need for leeway. However, the managerial mandate given must be consistent with an overall assessment of the operational qualities and the external demand, e.g., assessed through risk management. If the mandate oversteps the actual operational qualities, or if the leeway is a manifestation of presumption rather than actual competence and capability, the result may easily be a *riskier* rather than safer operation.

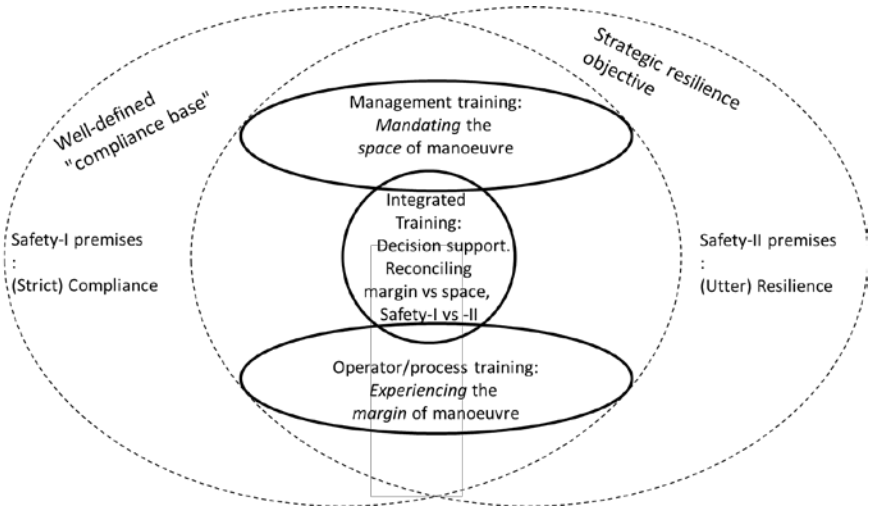

Figure 2 Distinct but coherent training arenas in the CvR context.

As illustrated in Figure 2, TORC comprise three distinct but coherent training arenas under the CvR umbrella with distinct but coherent objectives, namely:

- Operational training: reveal, articulate, develop and demonstrate the needed margin of manoeuvre in complex operations (when procedures are insufficient);
- Management training: articulate, explore, maintain and manage a mandated space of manoeuvre in complex operations;
- Integrated training: establish, calibrate, reconcile and sustain the balance between margin and space of manoeuvre over time.

3.2 Areas of application

Moreover, TORC is designed for three different overall contexts, namely:

- Training on normal operations (in which "Safety I" is defined by rules and procedures);
- Training on emergency situations (in which "Safety I" is defined by emergency plans);
- Training on "managing the unexpected" (in which "Safety I" must be identified and chosen there and then).

3.3 Navigating and manoeuvring in the CvR space

In order to operationalize the training focused on the CvR intersection (Figure 1) according to the objectives, we need a more fine-grained reference to enable trainees to find out where they are (navigating) and to find out where to go (manoeuvring).

3.3.1 Scaling and calibration; reference levels

The levels within the CvR space presented herein are introduced as a support for gradually building resilient functioning, and to have a calibration scale that can help to measure internal development and compare abilities for learning from others.

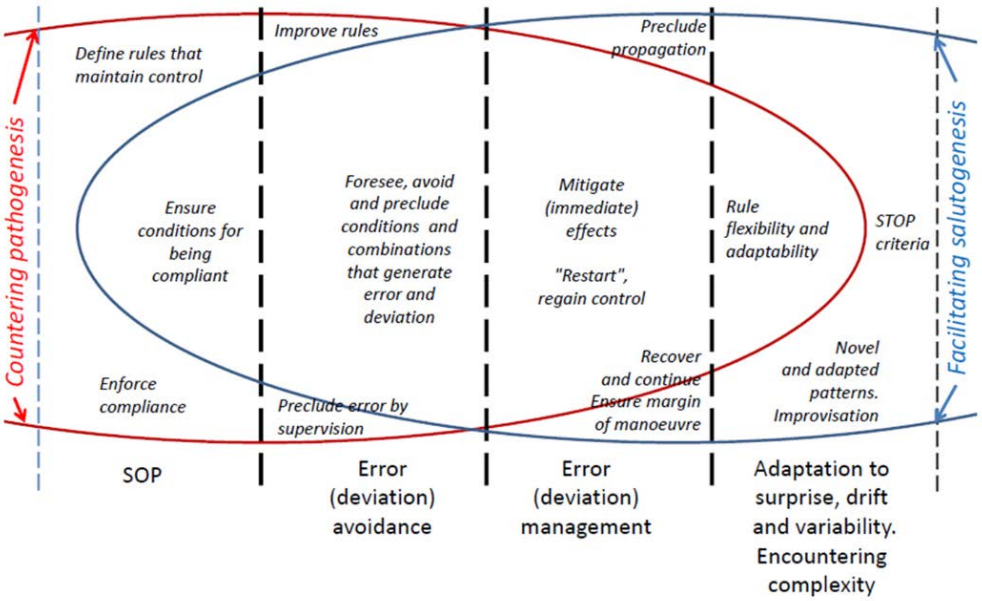

Figure 3 Demarcation of infiltrated practices (Grøtan, 2014)

However, the levels presented here are by no means meant to be normative, neither concerning the number of levels, nor the actual substance of each level. An organization can choose its own scale, and still utilize most of the TORC approach. It is also important to maintain that a "higher" level is not normatively "better". The "right" level is a matter of balance between actual skills, competences and resources, and the dynamics of the situation. A "right" level may thus not be even possible from the outset, but *may* be revealed or achieved through dedicated TORC training. The point of departure is however that "compliance" and "resilience" are "infiltrated practices", they are entangled in each other. Figure 3 depicts the first hypothetical attempt of describing the CvR space in terms of progressive levels of CvR "infiltrations". "Progressive" here denotes a gradual change of mix between[2] "strict" compliance and "utter" resilience.

As part of the conceptual development of TORC (see ref. TORC D1.1), these "infiltration levels" were further developed into four progressive *aspiration levels* for resilient functioning, inspired by Longstaff et al. (2013) and Woods (2015):

- 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 (R3) functioning over time

It should be noted that although R1-R4 are labels with names hinting primarily at the degree or level of "working resiliently", the premise of the CvR "infiltration" prevails. Moreover, as indicated in Figure 4, this progression of aspiration levels of resilience also implies a gradual change in the underlying functions. We denote the latter as "modalities", comprising[3] a gradual increase of challenge, from explication to improvisation.

- *Explication*: making an existing (tacit) practice visible and acceptable

[2] In Figure 3, "countering pathogenesis" suggest compliance, while "facilitating salutogenesis" suggest resilience.
[3] See TORC D1.1 and Boin et al. (2015) for a more thorough description

- *Interpretation*: being able a to identify the best available option for action, out of a set of pre-existing options
- *Sense-making*: being able to create a meaningful option (before choosing it), when none of the pre-existing ones will do, partly operating beyond the design-base of the system
- *Improvisation*: being able to stay in control through improvised acts, with little reference to the design base

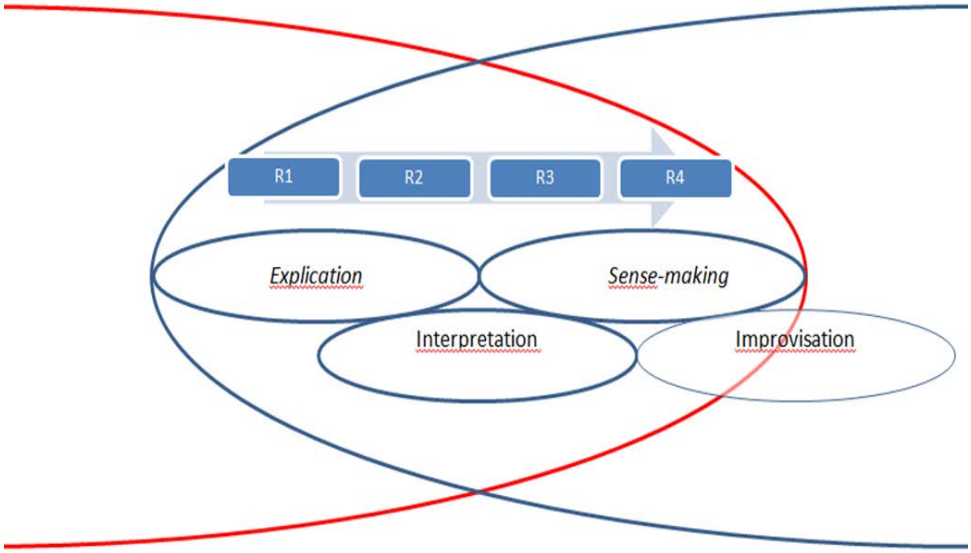

Figure 4 Reference aspiration levels and underlying modalities (see also D1.1)

3.3.2 The operational perspective: experiencing margin of manoeuvre as shifting competence envelopes

The notion of a *margin of manoeuvre* is not a static concept. Rather, during a course of action (trained or real), the actual level of resilient functioning (conceived as needed by the trainees) will most likely span a part of the R1-R4 spectrum. This movement during a course of action over a defined time period is denoted a *shifting competence envelope*.

As indicated in Figure 5, the foundational objective of an operational training scheme is to describe the shifting competence envelope for the situation or problem in focus. The gathering of one or more such trajectories, involving heterogeneous or homogeneous training groups, can spark a number of reviews and reflections, and provide a link or foundation for other (managerial, integrated) training arenas and sessions.

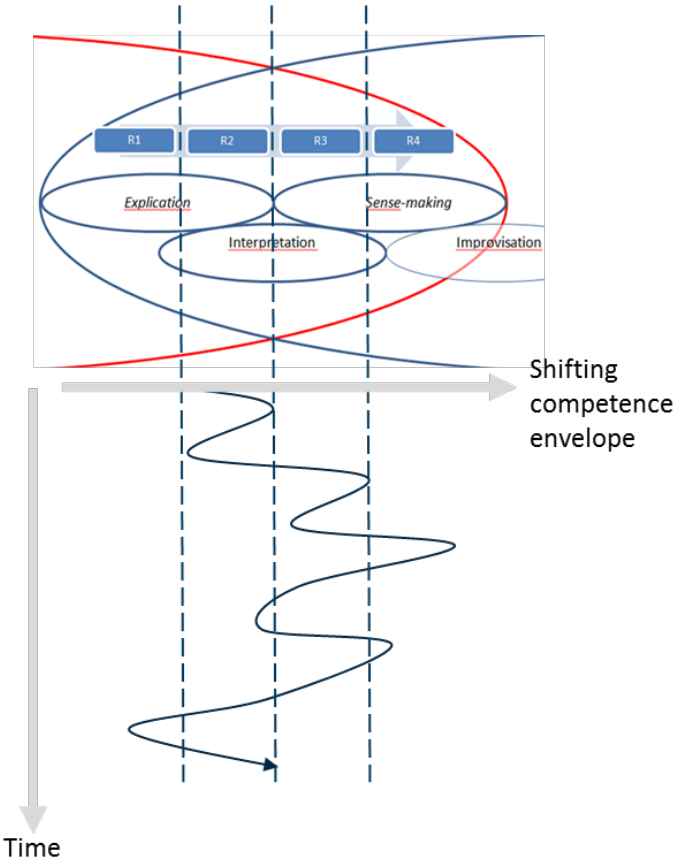

Figure 5 Shifting competence envelope (hypothetical example)

In TORC operational training, such a trajectory of a shifting competence envelope can be created through:

1) Introducing a successive set of hypothetical disturbances to more or less well-planned "normal" situation, that is, in all training applications as listed in chapter 3.2.
2) Reconstructing (real) past events and incidents

3.3.3 The managerial perspective: articulating and managing a space of manoeuvre

Knowledge of a shifting competence envelope is not necessarily a free pass for (resilient) action. The "needed" operational margin of manoeuvre derived from a set of shifting competence envelopes may not be a choice as free as the operational staff might wish or conceive. A managerial judgement must be made; is the organization/team as capable as actually needed, or are they taking chances, or being taken by the situation? Are they too vigilant? Is the "needed" margin of manoeuvre actually more dangerous or risky than useful when held up against organizational objectives and risk management concerns?

As illustrated in Figure 6, this implies two managerial foci that points at two different training objectives:

1) A *collective* managerial focus of drawing a[4] *baseline*[5] space of manoeuvre
2) An *individual (line)* managerial focus of dealing with the (singular) exceptions when the baseline is violated. What are the criteria to allow or deny? Will there be different rules for different teams or shifts? What is the managerial (decision) support needed to let it happen?

[4] Note that it is conceivable that different parts of the organization may be given different baselines
[5] In the example in Figure 6, between R2 and R3

3) *In addition*, for a normal operation, e.g., at an offshore petroleum situation, a *threshold* may be defined: when is it applicable to switch from normal to emergency mode and change focus to compliance with emergency plans? In which case, what is the threshold for going ("resiliently") beyond the emergency plan, before actually evacuating/abandoning the site?

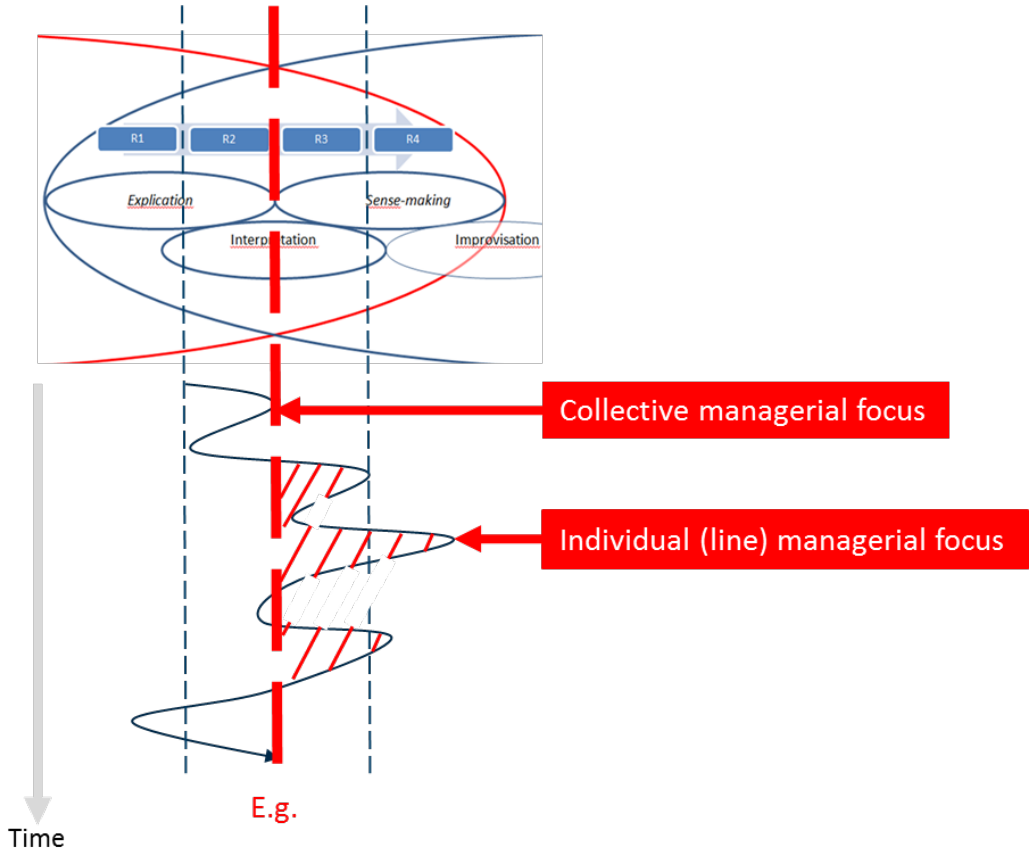

Figure 6 Two managerial foci (hypothetical example)

For the baseline, it is of utmost importance that it is aligned as much as possible across the operational and managerial perspective. Two cases of dysfunctional (and dangerous) non-aligned situations is visualized in Figure 7[6]:

- In one case, the management baseline is drawn at "strict compliance", while the operationally conceived margin of manoeuvre is almost "utterly resilient". That is, they practice resilience without managerial consent or awareness.
- In the other case, the management baseline indicates an unlimited trust in (and reliance on) resilient capabilities, but the operational side "work by rule" as much as they can because they expect a blame-game if something happens.

[6] In which, WasI denotes "Work as Imagined", WasD denotes "Work as Done". This contrast serves the purpose for the argument here, but is actually a rather gross simplification. Shorrock (2017) adds two other notions that could also be associated with the CvR perspective and TORC training objectives: "Work as prescribed" and "Work as revealed"

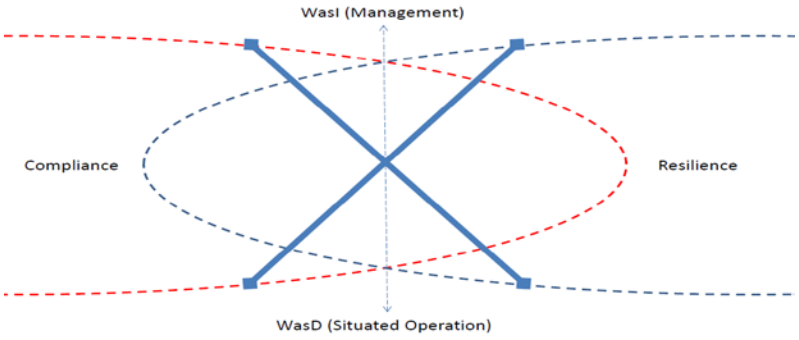

Figure 7 Dysfunctional baseline mandates: two extremes

Figure 8 illustrates the idealized situation, in which the operational and managerial conception of the baseline is in "perfect balance". However, keep in mind that the actual balance point is not a normative issue, but a local, situated issue, also reflecting a balance between:

- External expectations, accountabilities and mandates
- Inherent dynamics of system, actual capability of staff

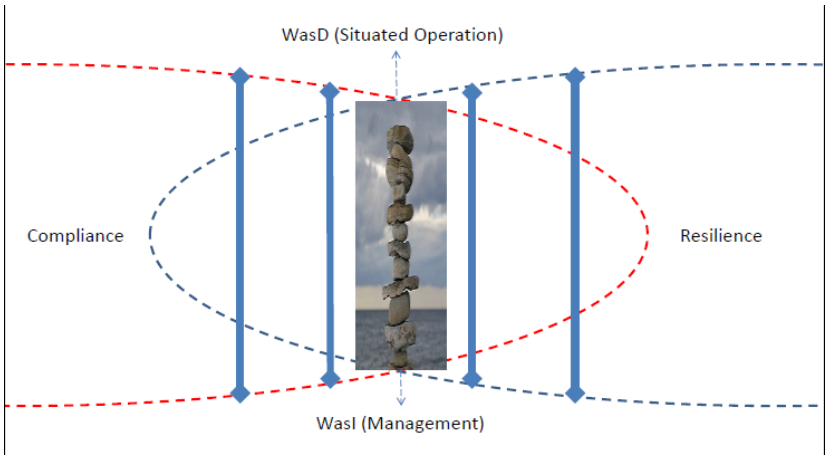

Figure 8 Functional baseline: situated rather than normative

In addition, a specific baseline may (and should) change over time, reflecting the adaptive history of the actual organization/system, a joint conception of the "precarious present" as well as a shared vison of a "resilient future". To accomplish this, the actual baseline assessment must be derived from a broader dialogue. This is the topic of the next section.

3.3.4 The integrated perspective: keeping it together over time

The integrated perspective directs attention to issues beyond the mere combination of the operational and managerial perspectives.

A key issue is a continuous process of CvR reconciliation. That is, neither an aligned baseline nor reasonable managerial intervention in singular situations will be sustainable if there not a continuous process of rule revision and development based on the actual adaptive/resilient experience. E.g., if, at level R1, a specific

way of defending a procedure is repeated over and over again, it should be considered included in the procedure. On the contrary, if a rule has to be repeatedly broken, its justification must be considered. A locally adapted guidance or reference for the local CvR "infiltration" or "entanglement", e.g., inspired by Figure 3, will be a useful tool.

The integrative process of CvR reconciliation cannot be supported by mere "facts" or "frozen snapshots" of the activity. The deliberations and reflections are best supported by narratives. It is therefore recommended to build a diverse repository of narratives that are both rule-centric (focusing on how rules can be effective), adaptation-centric (focusing on efficient and effective adaptation) and CvR-centric (focusing on CvR reconciliation, gradually building a locally adapted reference for entanglement, e.g., based on Figure 3).

So far, we have described a training activity in which new insights into operational margins, mandated spaces and CvR reconciliations follows a "natural" pace of discoveries and explorations. For various reasons, management may see a need to advance faster, and to "stress-test" (part of) the organization towards more dramatic conditions. In such a case, "managed anomalization" may be a strategic option.

3.3.5 Managed anomalization

Managed "anomalization" (Figure 9) may be a key component in the integrative process. That is, in addition to encouraging the operational staff to look for and provoke slips, weaknesses and vulnerabilities that may be hidden in the "normal" case[7], the managerial side can amplify or push this process by:

1) Intensify disturbances, seeking the limits of both experience, imagination and comprehension
2) Active contextual engagement (Barton et al. 2015); prepare to facilitate and acknowledge a shift in baseline, and/or supporting a more demanding modality (e.g., by explicitly signaling that "sense-making" is allowed, meaning that the operational staff is no longer constrained by predefined options for action, but are allowed to "invent" their own)

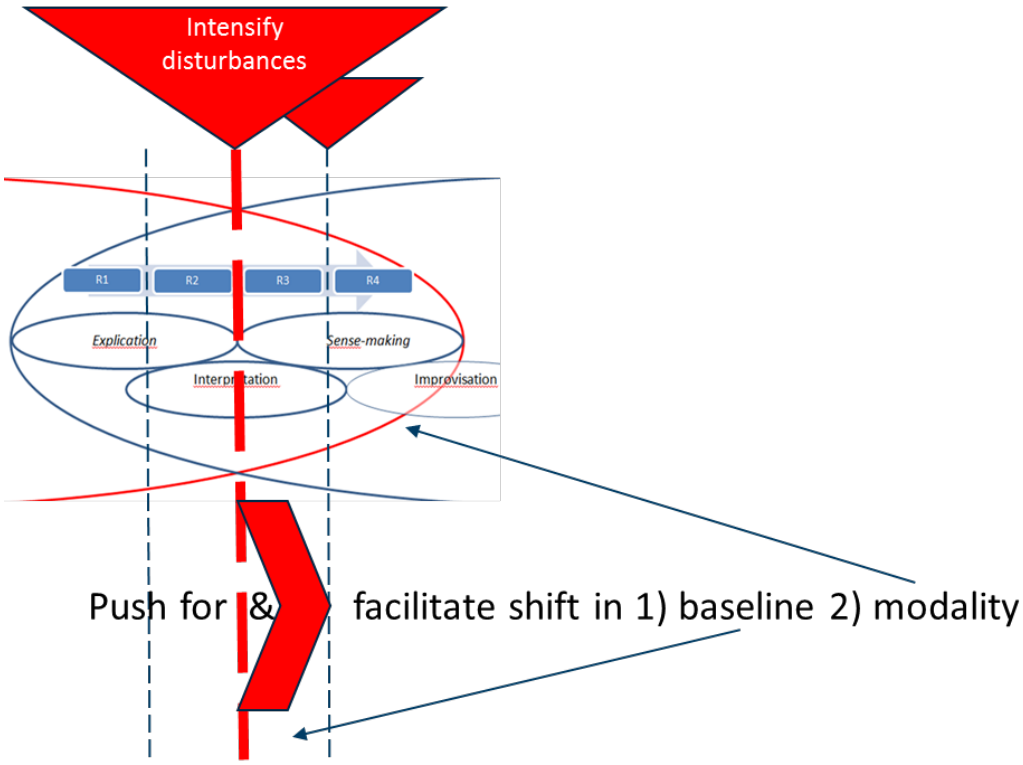

Figure 9 Managed anomalization

[7] That is, to "anomalize" may be recognized and appreciated as a legitimate operational stance and activity

4 The TORC gaming approach

4.1 The TORC Game inventory

The TORC board game was developed by TNO to support TORC training objectives specifically. Through piloting (so far) in the Netherlands and France (see chapters 7 and 8) it has been validated as relevant and productive for all intended types of training identified in chapter 3.3 and it carries a substantial potential for further, innovative combinations of operational, managerial and integrated training in different applications and contexts.

The TORC board game pad is illustrated in Figure 10. The game pad provides a simple way to structure the exploration/encounter of an operational dilemma with potential increase in operational risk, and it has been found supportive and productive for all types of TORC-related training foreseen so far.

Through various types of predefined cards, the game provides guidance on how the scenario may develop and which resources and strategies that can be taken into use to cope with the challenges that arise. However, the predefined cards do not need to be a constraint, as new disturbances, skills, competencies, resources and strategies can be developed en route (and "cardified" if wanted), depending on the choice of the game facilitator. In addition, investments and trade-offs related to mental load, perceived safety and efficiency may be an integral part of the game.

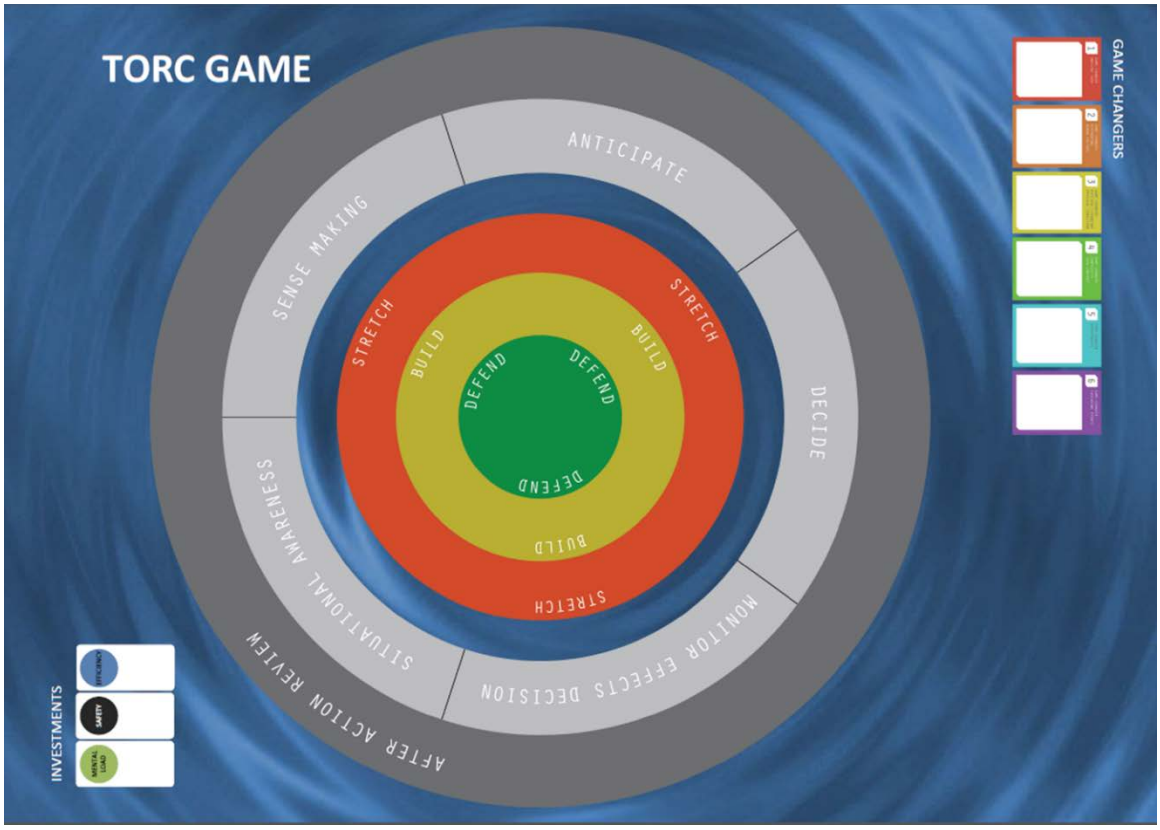

Figure 10 TORC game pad (6 players) (Source: TNO)

The inner circles of the game pad, labelled as *Defend*, *Build* and *Stretch*, correspond to resilience levels R1-R3 in Figure 4[8].

4.2 Playing the game

The game plays out from a predefined scenario in which the (5-6) participants can be assigned to different roles and external affiliations and contacts. As the first disturbance is introduced, e.g. by a "game changer" card, the group as a whole embarks on process denoted as "reflection in action" in Figure 11, comprising a process of five cognitive steps.

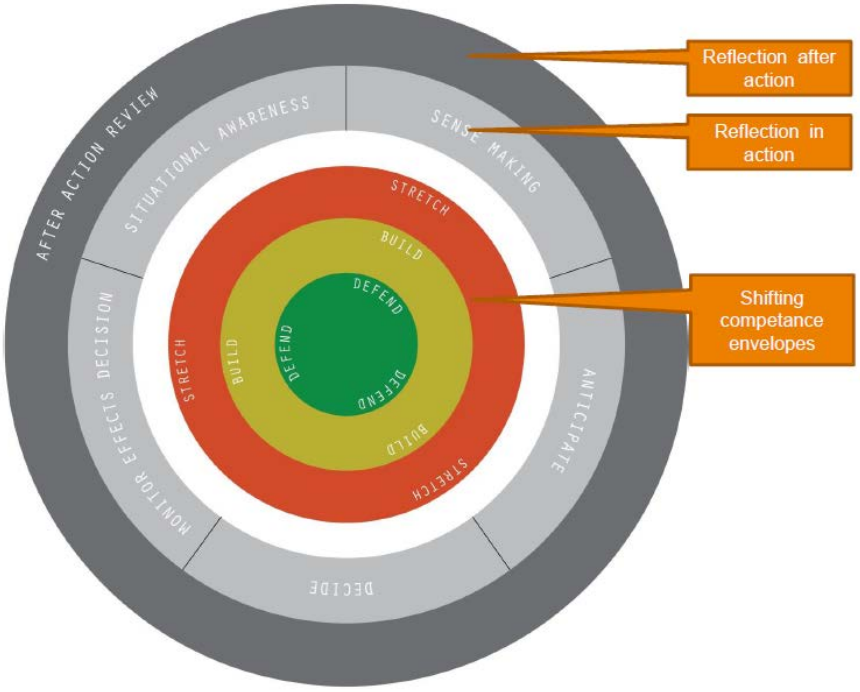

Figure 11 Key features of playing the TORC game (source: TNO)

The steps can be briefly described as follows:

1. *Situational awareness*: ensure that all possible relevant information is gathered
2. *Sense making*[9]: assess, as holistically as possible, what might happen, how the scenario and the disturbance might develop into something unwanted
3. *Anticipation*: elaborate the possible paths of action to counter the disturbance
4. *Decide*: the role of group leader may circulate during the game, but one person is urged to decide what to do
5. *Monitor effects*: elaborate on the possible effects of the decisions made, and assess where the attention of the group should be directed for follow-up

The group's conceived level of resilient functioning (R1 - R3) is assessed and recorded. Then, a new disturbance may be introduced. A more or less orchestrated scenario can thus be played out by successive

[8] R4 is omitted for practical purposes related to the actual pilots, but can easily be included if applicable. Alternatively, it can be monitored and appreciated in after action reviews, as a recurrent or sustained R3 level

[9] Note that the meaning of the term "sense making" as a cognitive step here has a more narrow meaning than "sensemaking" as an underlying modality in Figure 4

game changers. The game facilitator decides time constraints and circulation of roles within the trainee group.

As illustrated in Figure 11, the game pad thus directly represents the concept of shifting competence envelope (Figure 5) related to coping with a series of disturbances, and directly guides the assessment of each step and thus enforces a clarification of the rationale behind each shift. In addition, it lays the ground for an "after action review" conducted by the trainee group itself, and/or with/by an external group. Hence, it directly supports operational, managerial as well as integrated training in many forms and fashions. E.g., several (operational/managerial) groups can exercise the same scenario in parallel, and compare and evaluate the different results, from which a new level of reflection can be initiated.

4.3 Sustained Training by Gaming

The TORC game can be denoted a "sensitization device" as it is, given a trustful atmosphere, especially usable for visualizing and revealing the tacit practices that normally are performed "in the contextual shadow of the rational facade", as claimed in chapter 2. It may also cautiously address problematic issues or "taboos" in the organization.

By actively using the TORC game log (Figure 12), a trajectory of training results in a specific constellation can be preserved, forming a novel basis for reflection as well as new training set-ups derived from the training legacy of own as well as other organizations.

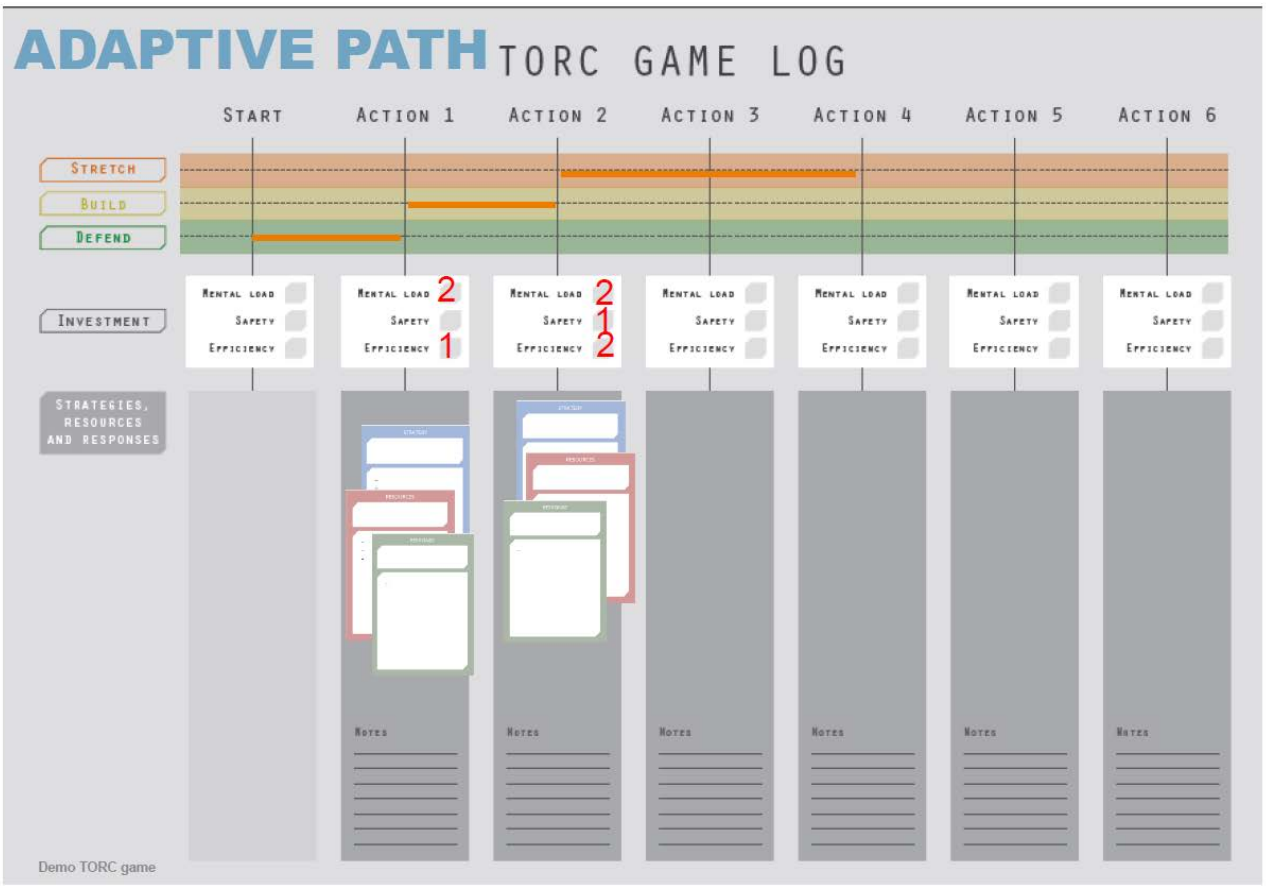

Figure 12 The TORC game log (source: TNO)

By primo 2017, the TORC game has been piloted in railway maintenance, oil and gas production and air traffic control, with more than 1.000 trainees.

Proposed skills, competencies, resources, strategies are proposed in D1.2 & D1.3. However, these are neither mandatory nor exhaustive for TORC training sessions.

The different roles associated with the staging of a TORC training sessions is also elaborated in D1.2/D1.3.

Hence, the TORC game support all modes of training indicated in chapter 3.3, and carries a substantial potential for being a vehicle for more sophisticated, accumulative and reflexive training schemes enduring a long time span.

5 Preparations for TORC training by gaming

A TORC training process is based on the CvR-informed structures and presumptions presented in chapter 2. Experience per primo 2017 indicates that these premises are easily recognized by industrial organizations within, e.g., rail transportation, air traffic control and the petroleum sector.

However, TORC training cannot commence before a similar recognition is verified and secured through a process that involves both management and operational environments affected. This may be conducted through half-to-1-day workshops with the affected communities, as well as a final expectation clarification.

For a TORC training program to be implemented, the following preparation must be carried out as a minimum:

- Verification that the "compliance base" (procedures and rules) for trainable scenarios are in place
- Description of practice scenarios (e.g. a maintenance operation) and the degree of disturbance/escalation that are meaningful in these contexts
- An overview of external resources and strategies that must be available in the training scenarios

A single training by gaming session typically takes 2-3 hours. There should also be in place a training strategy (see Chapter 6) that specifies whether the total number of training sessions should involve operational, managerial or integrated types of training, and to what extent these will build on each other (e.g., management training can be organized as a "replay" of previous operator training. Such a strategy can presumably be developed through a full/half day workshop when the foundations are established.

In TORC D1.2/D1.3, concrete guidance is given on the following issues:

1. Sensitization for TORC training and development
    a. Recognizing and understanding the potential for improved resilience
    b. Contracting and project set-up
2. Defining the Training Strategy and need for resilience for the company
    a. Consolidating and priming the compliance base and safety management
3. Intake and familiarization process
4. Working methods to support the familiarization process
    a. Selection of people to be involved in the project (company focus group)
    b. Explorative interviews and (mini) workshop
    c. Document scan/review
    d. Selection of use cases, scenarios and possible capabilities
    e. Interviews with key employees
    f. In-depth workshops on location

5. Identifying target group and start-up communication
6. Tentative training plan
7. Substantiation of TORC Training development
    a. Operationalization of scope of training
    b. Explore scope and targets of operational, managerial and integrated training
8. Development of TORC training content
    a. Sources and inspirations of functionality addressed in Training Elements
    b. Exploring the capability concept
    c. Exploring and prototyping tentative interactive patterns
    d. Identify enablers that should be included in the Training Strategy
9. Developing a detailed Training Strategy
    a. Learning style
    b. Training Elements
        i. Shifting competence envelopes
        ii. Systematical consideration of action alternatives
        iii. Training Formats
10. Conducting training
11. Evaluation of training

In addition, D1.2/D1.3 describe the TORC Game in more detail.

6 Training Strategy

TORC D1.1 describe a rather intricate structure in which a Training Strategy comprises notions of Training Objective, Training Target, Training Elements and Training Formats.

The experience of using *gaming* as Training Format suggests that a number of key objectives, targets and elements are implicitly covered by the TORC game format and setup as described in chapter 4. Employing the TORC Game therefore implicitly engages the essential training objectives and targets, and sets out the direction for a number of plausible training elements that bridges operational, managerial and integrated training.

6.1 Strategic objectives

The minimum recommendation is that a candidate TORC trainee organization articulates a strategic resilience objective (Figure 13) that clarifies:

- why resilience is important;
- how resilience is expected to manifest in the organizational objectives;
- how and to which extent the CvR perspective resonates with the organizational needs and contextual demands;
- how resultant training targets map to operational, managerial and integrated TORC training, respectively; and
- whether, and in which manner, managed anomalization or other means for stress-testing is part of the objective.

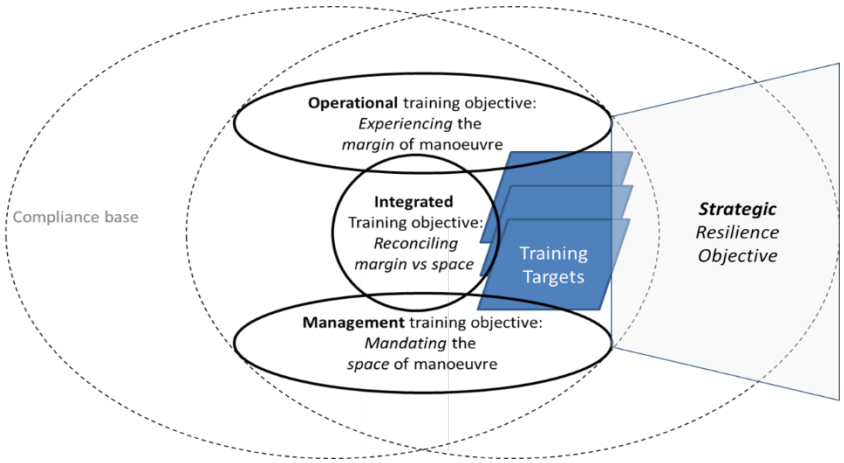

Figure 13 Strategic training objectives and targets

Specifically, the candidate TORC trainee is urged to make an early strategic consideration on the overall objective and purpose of TORC training. As indicated in Figure 14, such purpose can range from a modest appreciation of existing adaptive practices (revealing rudimentary resilience), to developing these gradually through cautious experimentation, to aiming for organizational adaptation, prioritization and formalization, from which a *resilience capability* ultimately is established as part of the organizational repertoire and integrated with the key processes of, e.g., service delivery.

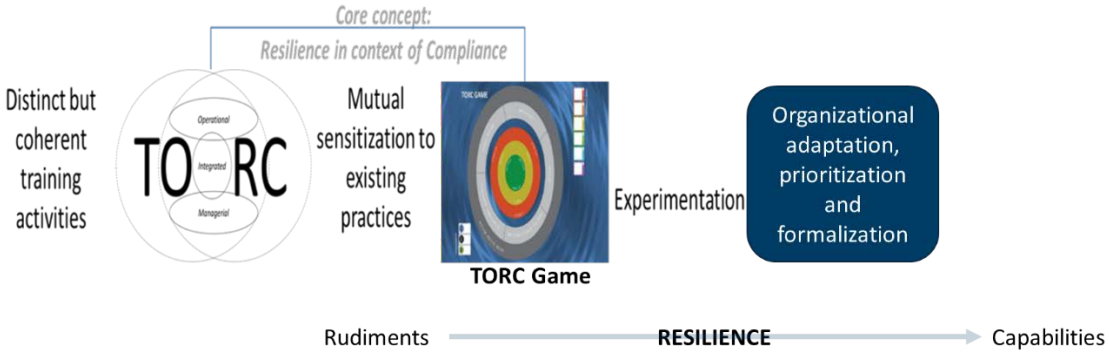

Figure 14 Ambition range of resilience training targets

6.2 The TORC Capability Concept

The TORC Capability concept is illustrated in Figure 15. Here, skills, competences, resources are made visible and available, ready to be organized and leveraged through distinct strategies. The result is a "packaged" capability, which in turn can be an integral part of a service delivery process.

If the strategic resilience objective is to develop full-fledged capabilities, the following "TORC disclaimer" should be noticed: if the capability eventually is formulated as a sheer instrumental prescription or "recipe" for action, it might no longer be about resilience. Rather, it might be more affiliated with the "C" side of the CvR model", rather than the "R". In the worst case, "resilience" per se might be lost on the road to the Resilience Capability.

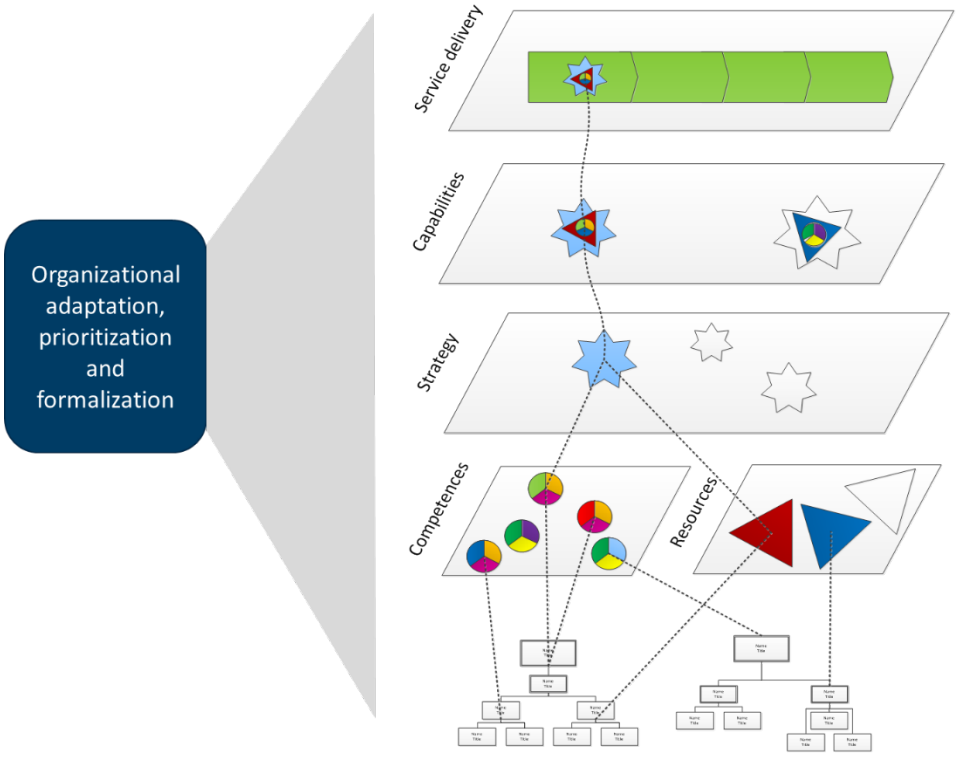

Figure 15 TORC Capability Concept (source: TNO, D. Zuiderwijk)

7 Expected benefit from TORC

Upon completion of a TORC training program, an organization can expect to have gained:

- a unique opportunity to gain insight into hidden, tacit but necessary practices in its own organization;
- a window to better understanding of operational risk;
- experience with a conceptual framework and a methodology that gives management the ability to formulate (and take responsibility for) an operational resilience encapsulated by a managerial mandate, enabling sustained harmonization between how work ideally should be done ("work as imagined") and how the work is implemented in practice ("work as done");
- a sustained and productive dialogue between personnel with different perceptions and perspectives on safety; and
- a flexible "gaming" platform for further development of safety, with many opportunities.

8 Experiences and feedback

Based on the experiences reflected in the final TORC workshopAppendix 2, the following is extracted:

8.1 Added value from TORC training by gaming

- Identification of critical roles in the existing organisations for dealing with emergency
- Emergence of roles which could be entitled for coordinating responses
- Experiencing the limits of available procedures
- Identification of possible shortages in organisational resources
- Identification of potential communication flaws
- Identification of specific training needs

- Help to look for the presence and lack of tools and control options of persons at the job to cope with unexpected situations
- Understand that compliance and resilience do not automatically influence each other in emergency situations
- Understand that people react naturally to solve situations they encounter, regardless of rules.
- Personnel is driven by two main factors (safety of workers and availability of the infrastructure) while solving unexpected situations.
- Trained persons become more aware of the consequences of actions and decisions they make to other parties (colleagues, contractors, etc.).
- Can be combined with the Shell Heath individual resilience training program
- Can be used for various other cases not yet piloted, including training for other disciplines
- The internal trainer/facilitator role can be extended
- Can be used in relation with incident investigation
- The game, and especially the five steps, help to look for small changes and their significance

8.2 Needs for improvement and further development

- Support to find the appropriate balance in the surprises regarding:
  - Match the hierarchical responsibility for decision making
  - Avoid falling in trivial “daily surprises” for personnel which job is a constant adaptation
- Represent in the game, the dynamic aspects of ATM[10] domain (connection with operational context)
- Integrate TORC training in a larger organisational reflection
- Support when management has to decide to either let the present escalation model be used, or to delegate decisions to a lower organisational level.
- Enhanced facilitation for regular work evaluation, specifically in using the “five step model” during evaluation of regular work and/or usage in incident investigations.
- Field staff have experienced difficulties in choosing strategies andresources, and these should be made easier. It takes at least one play-round to familiarize. A further differentiation between strategies for fieldstaff and management, and simplification is needed.
- The game itself does need much attention and preparation regarding own and recognisable business cases, including gamechangers, strategies and resources.
- Counter group think – create various role templates, e.g. "advocate of the devil"
- Tools to keep the training alive: posters – booklet – game board as sticker on table
- Enhanced clarity wrt to the investments: safety- efficiency – workload
- Means to gain information of the mindset of the key employees ("champions") who make real differences
- Develop an improved assessment scheme
- Specific training for key employees (facilitators and champions)
- Learning directly from things that recurrently "get it right"

9 Prospects of future TORC development

Substantial experience is gained so far through the piloting activities referred to in this report. However, and fortunately, this "basic" use of TORC is in its infancy. There is still much more experience to be *gained* and *shared* on the basic training activities described in this report.

At the same time, it is already easy to spot open doors to new arenas, issues, agendas and overall objectives for the use of the TORC.

[10] Air Traffic Management

9.1 Professional competence and the learning organization

One example is indicated in Figure 16, in which TORC can be used to deepen professional competence and organizational learning, motivated by a need to compensate for retiring staff. This is a prospect TORC application already developed by the TORC Consortium and associated partners, under the label SenZMAN[11].

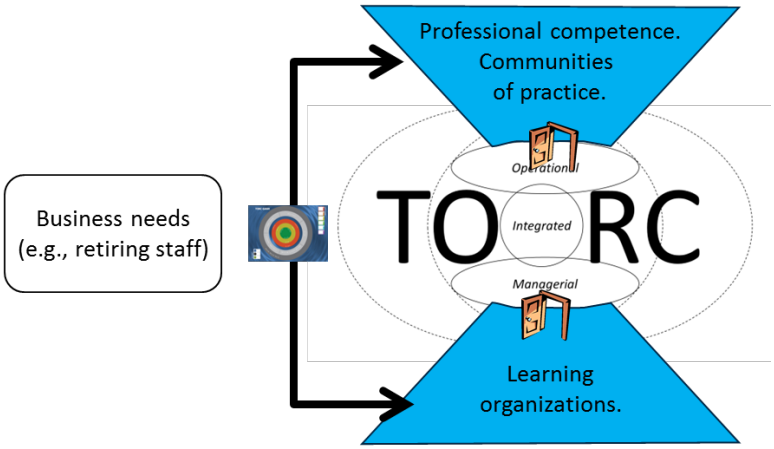

Figure 16 Example of extended applicability of TORC

9.2 Polycentric resilience, managed anomalization and stress-testing

Ultimately, resilience is not an issue of centralized control in a networked industrial and work environment. The TORC game setup with training groups of 5-6 persons is already primed with the premise of coordination, not only with local management, but also with other operational nexuses in a system depending on polycentric[12] governance for resilient functioning.

The premise of a homogenous or unified approach to resilience in such a heterogeneous system is not realistic. Instead, such a scheme could rest on the notion of a calibrated resilience landscape of autonomous actors, each of which resting on the CvR premise, but with different aspiration levels and resources available, operationalized as resilient subjects, objects and rationale (Figure 17).

[11] "SensitiZation into capacity to MANoeuvre from professional experience through game-based training"
[12] Eg., as depicted by Ostrom (2001).

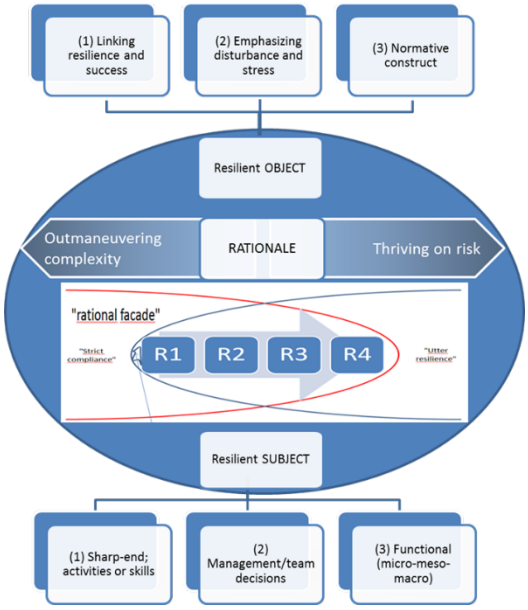

Figure 17 Reference model for entities in calibrated resilience landscapes (Grøtan and Bergström 2016)

Irrespective of their differences, the resilient entities will have to coordinate their efforts. As indicated in Figure 18, the TORC approach and the TORC Game can be extended to serve such a purpose. Each TORC training nexus could then be profiled as a "calibrated" entity" according to the model in Figure 17.

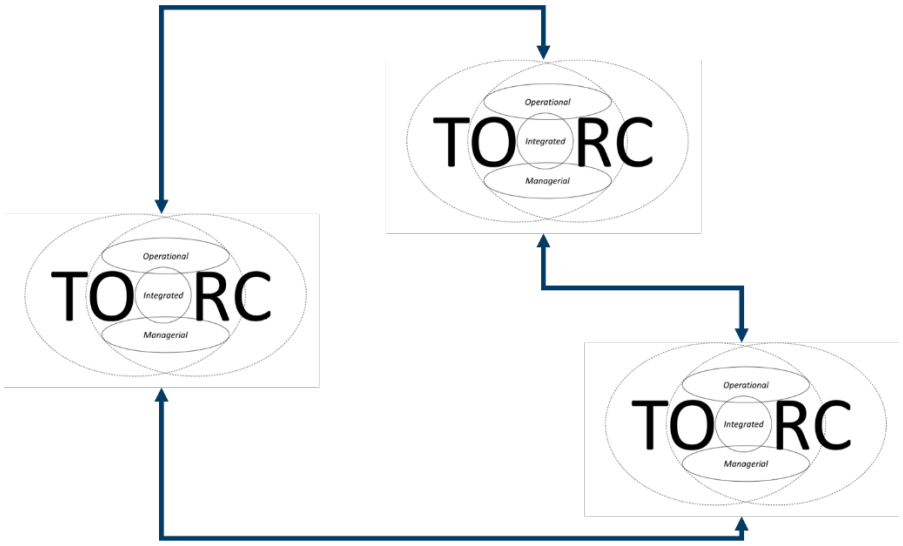

Figure 18 Prospect of a polycentric TORC training/gaming arrangement in a resilience landscape

Furthermore, by employing "managed anomalization" (chapter 3.3.5) or similar approaches, TORC can also function as a backbone for stress-testing of individual resilient entities, or polycentric resilience in terms of "calibrated resilience landscapes" (Grøtan and Bergström 2016).

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