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TNO report

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WP3: A report summarizing preparation and implementation of the TORC training modules (D3.1-D3.3)

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Management Summary

The main goal of the TORC project is to deliver an innovative training framework and method that facilitate sustained development and management of operational resilience capabilities that make safety management more adaptive and reliable under uncertain and shifting circumstances. The key research question is: *How can operational resilience capabilities be created or reinforced through training activities for managers and operational personnel, addressing everyday as well as emergency situations?* The objective of *adding resilience* as an operational capability reflects the need for additional capacities to manage variability and cope with surprise, but also embodies the awareness of resilience as a *fallible* practice. The exertion and management of resilience can however not evade the *imperative of compliance* that pervades regulations, management styles and procedures in most industries. As resilience embodies an alternative way of thinking about safety, the adoption of resilience-based adaptive principles will create friction. Hence, reaching this target demands a continuous process of reconciliation and reflection that may manifest differently at the operational and the managerial level, and in which TORC training is exercised on the basis of rules and procedures.

The current document describes the most tangible outcome of the project being tested (i.e. the TORC Game) in three pilot companies in The Netherland. The game operationalized the concept of resilience into a practical and effective training program on three levels: operator, management and integrated training. The objective of work package 3 was to derive scenarios from chemical/oil and gas industry and (high speed) rail road cases, past accidents and relevant everyday operations, and to apply the TORC Game prototype in the specific operational and management cases. TNO developed the different training modules and piloted them with all three companies. For the benefit of improving resilient behaviour an integrated training was developed where both operators and managers play their own part. The scenarios played at operator level are reused during the management game; the outcome of both trainings were used as input for the integrated training in which both parties participate. The focus is on the interrelated aspects of handling resilience related problems. Different resilience strategies and resources are trained. Examples are communication, problem solving, team coordination and identifying lessons learned for the team. After Action Reviews (debriefings) and feedback loops were developed in which managers and operators provide each other the necessary feedback based on the results noted on a log poster. The TORC game was tried out with target group end users in the participating pilot companies.

In all Dutch industrial settings the training worked satisfactory. Both field staff and management were able to deal with the cases to assess them according to the pre-defined steps and cope with the problems. The groups differed in the way they acted, but registration of the choices on the log poster made it possible to discuss those choices and the used resilience strategies and resources. A short summary and more detailed overview of the findings and results per pilot company can be found in chapter 3 to 5.

Although we distributed the TORC Evaluation Questionnaire (as developed in WP5) in all pilot companies after the pilots to evaluate the TORC Game we only received enough response from NAM employees to perform basic statistics that actually are informative enough with regard to TORC training effectiveness on Kirkpatricks evaluation Level 1 and 2. Therefore, only the NAM results are described in this report. With regard to the degree to which NAM participants liked the TORC training and believed it would help them with their job, the degree to which participants are actively involved in and contributing to the learning experience (engagement) and the degree to which training participants will have the opportunity to use or apply what they learned in training on the job (relevance) most participants of the training (i.e. reaction) agree that the TORC game does all that. With regard to the degree to which training content was acquired by the trainees and the degree to which participants acquire the intended knowledge, skills, attitudes, confidence and commitment based on their participation in a training event (i.e. learning) it appears that with every question one or two respondents disagrees with the statement. And a lot more seem to be neutral in their answer with different statements. We did not obtain any additional comments that would give us more insight into why this is. Overall most respondents have learned to reflect and evaluate how positive and negative experiences with resilience in practice contribute to improving the operation. Also, most have learned to reassess the mandated decision making space with the space of maneuver they need during unexpected situations or circumstances during work.

Several recommendation were identified. An important enabler for the training was to choose and analyse relevant company cases of both negative and positive experiences with resilience. It seems difficult to trace the choices made by the training group because the notation of the choices were not consistent. A recommendation is to improve notes by using ICT support tools. Moreover, let one trainer track the teams elaborations during the different play rounds to get a more accurate report of what happened and which choices are made why during the game including observation reports by the team observers. Also, further study is needed to explore what task specific and generic competences could be enriched by behavioral characteristics (and strategy use) which enhance resilience. Moreover, the way in which the learned competences are transferred to the work environment also depends on the job aids or instruments used to bridge the learning environment and transfer of training towards the work environment. Some examples that were discussed with industrial partners during the close out sessions were: stand tables in the canteens field staff could use to discuss for start work, with problems or issues. Moreover, in the After Action Review questions related to the teams resilience performance are asked to encourage teams to systematically review their work more often and to let other teams in their organization to learn from their experiences; both examples of successes and failures are input for such reviews to improve overall organizational learning. Finally, different organisational resources are seen as important enablers of resilience capacity: balancing organisational stability and flexibility, having a just and fair culture and facilitating the learning organization.

Contents

1 Introduction

1.1 Background

- Resilience in the context of compliance requires well considered action to adapt to variance and disturbances to work.
- A serious game is developed to train and raise insight on how to adapt resiliently

1.2 Pilot Goals

- To develop together with the pilot companies a concept for the TORC training based on a serious game
- To pilot TORC with operations, management and both in an integrated session
- To deliver a training format for the participating companies

1.3 TORC program approach

- To cooperate with research partners SINTEF, Dédale and industry partners ENI, Strukton Rail, Infraspeed Maintenance BV and Air Traffic Management Charles de Gaulle
- To exchange knowledge and experience on resilience engineering with Dutch pilot industries
- To collect and analyze scenario's with positive and negative outcomes being managed resiliently
- To explore the resilience concept in the context of safety, compliance and training policy of participating companies in meetings, Dutch industry focus group, and several workshops
- To develop a working concept and prototype for a training format based on serious gaming, using TNO knowhow, theories of primarily Woods and Hollnagel and explored in a mock up (December 2016) with safety and health staff and operational management of participating companies
- To select 2 cases from operational activities of participating companies to be used in the training, specify company specific strategies and resources to be involved in the training.
- To conduct a pilot for: a. operational field staff, b. management and safety staff, and c. both in an integrated session.
- To evaluate in close-out session and advise on follow up for each participating company

2 Dutch Pilot approach

With every industry partner a planned stepwise approach has been followed with the main steps being:

A. Contracting
B. Intake and communication
C. Selection of relevant people to be involved in the project
D. Explorative interviews and workshop
E. Document scan/review
F. Interviews with key employees
G. Select use cases, scenarios
H. In depth workshop(s) on location
I. Operationalizing scope of training
J. Prepare detailed training plan
K. Conduct training
L. Evaluation
M. Conclusions and guidance for further work

As part of this process a series of dialogues, meetings and workshops has been set up with both top management, operational management, safety and health staff and operations (local management and field staff). This resulted in diverse and valuable input to both the development and piloting of the TORC concept and TORC-training prototype.

2.1 Goal of the pilots

The first aim was to share knowledge and experience to answer the following research issues:

1. To explore the dynamics on the interface of compliance and resilience dynamics when acting in a high risk environment?
2. How does a resilience practice fit in the company's operations?
3. To investigate what capabilities operations and management need to act resiliently in the context of compliance?
4. To search for a method to strengthen these capabilities.

The second aim was to co-create and cooperate in developing a training method, to test it and to evaluate it in pilot sessions as needed and to be agreed upon.

2.2 Generic findings and results

The pilot project was able to follow the approach as planned in an iterative way. Research and development interacted while developing a concept and a final prototype of the TORC training. The industry partners still work close together in this process enabling exchange of experiences, ideas and knowledge. Since the training strategy was primarily build on the idea that the TORC-training should be built on a training for field staff, management and an integrated training, the TORC

training strategy for the Dutch industry stakeholders has been prepared in that way. Each pilot followed the same structure and approach. The main difference between the gaming approach originated during test sessions. And had to do with company specific cases customized towards the company specific service delivery process, and domain specific game changer cards, strategies and resources.

At a first mock up session the TORC concept was assessed by means of a walkthrough of the training set up and the serious game as designed so far. It was combined with a try-out of the TORC game. After integrating the results of the mock-up session in an iterative way of working with other industries and via several "lab"-tests of TNO a final prototype has been[1] designed and produced.

The first try outs proved that the TORC concept was working. An important step was to erase academic language and to use 'normal' vocabulary as far as possible without losing the sharpness of the underlying models and theoretical fundament. This resulted in a final training strategy and format:

- A program including training of field staff, management and integrated groups (field staff and management)
- A program including resilience in action and resilience after action (after action reviews leading to individual and company/organizational learning)
- A working method: instruction, serious game play complemented with group discussion, moderated by a trainer/coach. These were supported by training aids:
    - Placemat with 10 selected strategies and 5 clusters of resources
    - A short guide of the game
    - Forms for the observers
    - A log poster for plotting relevant issues as a result of the game play:
        - Decisions taken
        - Strategies and resources deployed
        - Modes of resilience chosen when responding to a diversity of challenges (being induced by game changer cards)
        - Notes
- A TORC booklet with a summary of key concepts of resilience, TORC and supporting information on strategies and resources.

Moreover, the resulting pilot training targets were:

- To experience resilience in action in a simulated environment
- To learn to deploy operational resilience capabilities when coping with unexpected changes and situations
- To explore and learn to apply strategies for resilience performance
- To explore and to learn to deploy company resources and other resources to support adaptations during work
- To experience the value and importance of relationships in or outside the team with an eye on strengthening resilience adaptations
- To learn to reflect and evaluate positive and negative experience with resilience and how this can contribute to a stronger (more resilient) organisation
- To review decision frameworks to (re)define and mandate space of manoeuvre.
- To strengthen the relation between field staff and management in their mutual responsibility to improve operational resilience

[1] For a concise description see the TNO/SAF€RA booklet: Fostering resilience through changing realities, introduction to operational resilience capabilities (TNO, 2016)

3 Close-out report of TORC Pilot NAM

3.1 Short summary

3.1.1 Findings and results

- NAM was capable to introduce and assess the usability of resilient concept in its organization.
- Resilience in the context of compliance is a very relevant capability to be explored, trained and strengthened.
- Through all sessions each work method from mock up test to pilots created awareness for strengths and opportunities to improve resilience and evaluate compliance policy and operational experience.
- The open and challenging character of the TORC set up, its gaming concept and it structure with players and observers energized participants leading to a vivid exchange of experience, peer review and outlook for concrete follow up in operations and for training purposes.
- TORC encompasses both a mental decision making loop and choices for resilient strategies. By simulating this dynamically in a serious game based on a variety of company cases several capabilities can be trained.
- The prototype was considered as mature and capable to be implemented by NAM trainers in the aftermath of the pilot already.

3.1.2 Impact of the pilot results

- The pilot elicited a diversity of resilience experiences relevant to be shared and trained further.
- The TORC game supported the awareness of the resilience concept and its potential strength for using it in company specific work contexts. It appears to be a very natural way to intensify communication and cooperation between field staff and management on operational issues needing resilience.
- It opens up shared views on specific directions to strengthen operations.
- NAM opened up a constructive dialogue on relevant competences and behaviours expected from operations and management.
- NAM was ready to implement TORC by itself directly and is already implemented by NAM in a training program.

3.1.3 Prospects and further developments

- Resilience in and after action provide space of manoeuvre for adaptive practices but needs further evolution of policy, management could intensify the way the support and position resilience in the organization, supporting system and just culture, competences for resilience capabilities.
- Develop dynamic risk management that constantly assesses risks and mitigates risks, and short learning loops (in preparation and reviewing a specific work supported by structured storytelling and after action review for both operational teams and management.
- Connect learning with work and training aids to support change of behaviour, cooperation and harmonize it.

3.2 Introduction

NAM is an Oil and Gas exploring company in the Netherlands and is one of the Dutch pilot partners in the project Training for Operational Resilience Capabilities of the SAF€RA-TORC consortium (SINTEF, TNO and Dédale), and contracted via a Formal Consent as Industry partner. TNO set up a complementary bilateral pilot contract to agree on operational issues and output expected. NAM participated in the SAF€RA project intensively and constructively.

Figure 1, one of the NAM plants

Pilot sessions were conducted on the 18th (with field staff group of eleven people) and 20th of February 2016 (with management group of seven people, and the integrated with around eight field staff colleagues additionally). Some pictures of these sessions are given below.

Figure 2, training field staff

Figure 3, training management

Figure 4, integrated training and log posters of the other sessions with the same scenario and game changers

3.3 Company specific game setup and game play

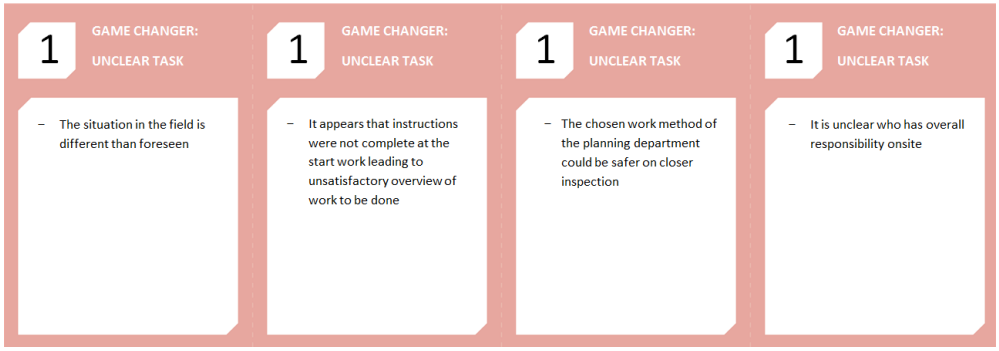
The following case was used.

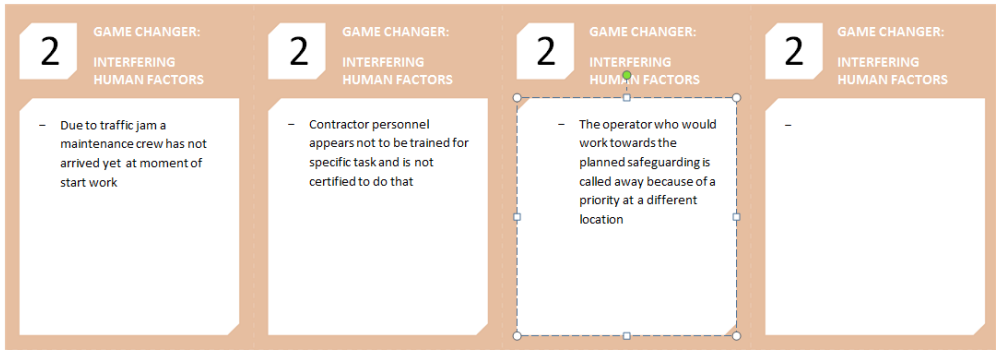
Case 1. Compressor maintenance

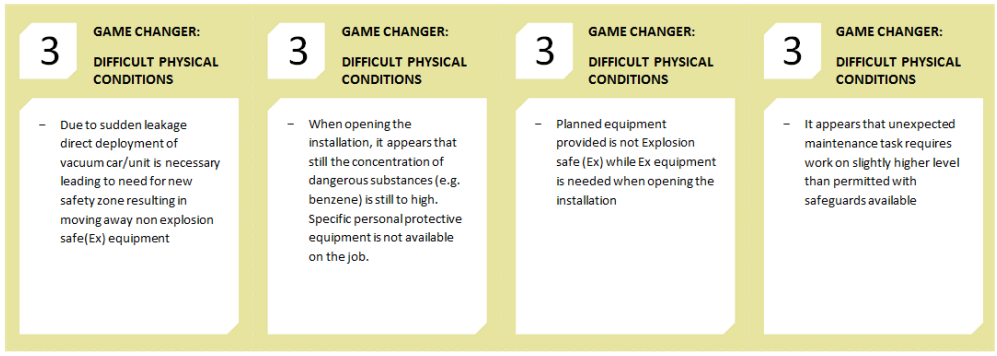
- Prior to maintenance work on the compressor in the installation a safe working environment must be created for the maintenance staff. This implies that the installation should be made pressure and product free secure in accordance with the securing procedure.
- Under this procedure the compressor should be parted prior to the maintenance work. It was decided to work behind an alternative safeguard (behind one valve and proven pressure-free).
- Situation: the operational team is on site and the maintenance crew is yet to come.
- Activities:
  - The contractors are not aware of the fact that there is a deviation from the safeguarding instruction. The safeguard, as applied, is entirely discussed with the people who will carry out the maintenance.
- Trigger start game: What is your assessment of the situation: defend; build; stretch? After the assessment the first game changer is handed out to the first team leader

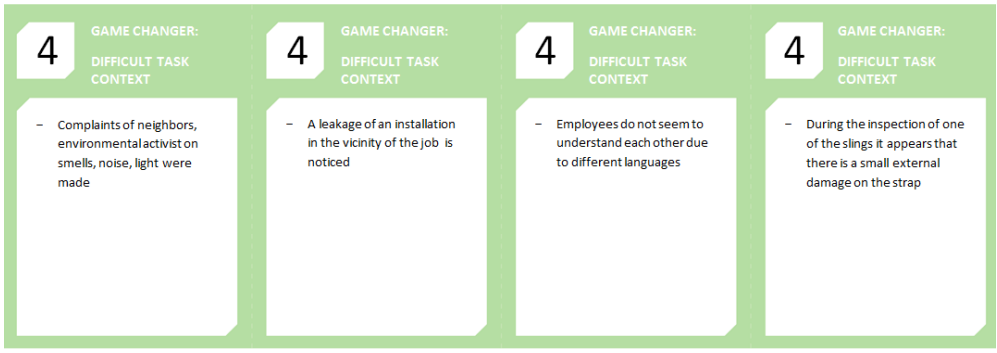
Company specific cards used

Some examples of customized game changer cards in different categories:


1
GAME CHANGER:
UNCLEAR TASK
– The situation in the field is different than foreseen
1
GAME CHANGER:
UNCLEAR TASK
– It appears that instructions were not complete at the start work leading to unsatisfactory overview of work to be done
1
GAME CHANGER:
UNCLEAR TASK
– The chosen work method of the planning department could be safer on closer inspection
1
GAME CHANGER:
UNCLEAR TASK
– It is unclear who has overall responsibility onsite


2
GAME CHANGER:
INTERFERING HUMAN FACTORS
– Due to traffic jam a maintenance crew has not arrived yet at moment of start work
2
GAME CHANGER:
INTERFERING HUMAN FACTORS
– Contractor personnel appears not to be trained for specific task and is not certified to do that
2
GAME CHANGER:
INTERFERING HUMAN FACTORS
– The operator who would work towards the planned safeguarding is called away because of a priority at a different location
2
GAME CHANGER:
INTERFERING HUMAN FACTORS
–


3
GAME CHANGER:
DIFFICULT PHYSICAL CONDITIONS
– Due to sudden leakage direct deployment of vacuum car/unit is necessary leading to need for new safety zone resulting in moving away non explosion safe(Ex) equipment
3
GAME CHANGER:
DIFFICULT PHYSICAL CONDITIONS
– When opening the installation, it appears that still the concentration of dangerous substances (e.g. benzene) is still to high. Specific personal protective equipment is not available on the job.
3
GAME CHANGER:
DIFFICULT PHYSICAL CONDITIONS
– Planned equipment provided is not Explosion safe (Ex) while Ex equipment is needed when opening the installation
3
GAME CHANGER:
DIFFICULT PHYSICAL CONDITIONS
– It appears that unexpected maintenance task requires work on slightly higher level than permitted with safeguards available


4
GAME CHANGER:
DIFFICULT TASK CONTEXT
– Complaints of neighbors, environmental activist on smells, noise, light were made
4
GAME CHANGER:
DIFFICULT TASK CONTEXT
– A leakage of an installation in the vicinity of the job is noticed
4
GAME CHANGER:
DIFFICULT TASK CONTEXT
– Employees do not seem to understand each other due to different languages
4
GAME CHANGER:
DIFFICULT TASK CONTEXT
– During the inspection of one of the slings it appears that there is a small external damage on the strap

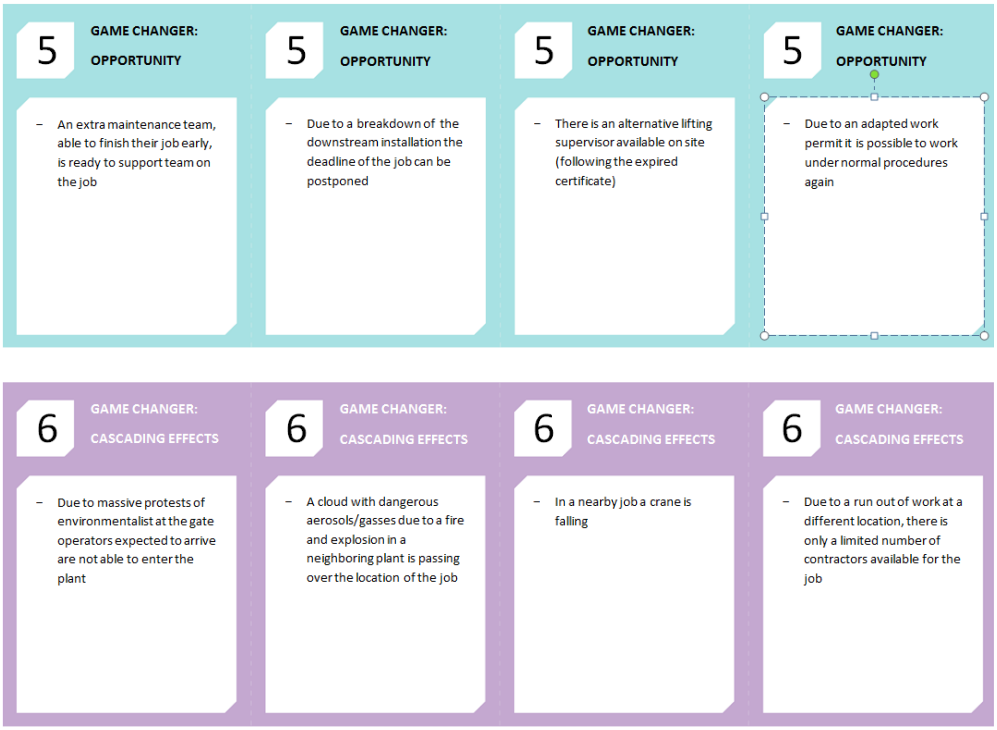


Figure 5 Game Changer cards NAM

3.4 Findings

Field staff training:
The field staff participants were very intrigued by the training and the game play. They were after the introduction, without any exception, directly immersed by the presented case, the team interaction and the process steps in each round. The resilience resources and strategies used by the team were input for debate. Furthermore, the assessment and effect after each round on workload, efficiency and safety provided insight into the impact on both the operation and organization.

Management training:
Management has to act as a field staff team. In this they played the role of operational team with the same case presented as a starting point. They were very much engaged, and the game play led to interaction between the team members and possible effects on the task, the team and the organization. The resilience resources and strategies used by the team were useful for the team members. They judged the case as very realistic and acted as they were the field staff team. They reflected on the role of the team, the challenges they faced and on their role as managers.

Integrated training:
In the integrated training both field staff and management were invited to present briefly about their experiences and outcomes of their training session. This was done plenary and guided by one spokesman. They first described how the training went; the process and the way the group acted during training. After this the log poster was explained and elaborated by the presenter: the choices made, the resources and strategies used, and their first assessments of the situation during the game (i.e. defend; build; stretch). During the presentation a group discussion

was part of the integrated session in which some participants were quite emotionally involved. This was considered to be a positive and necessary effect of the training that the discussions about facilitating the team and the problems they experienced in the work environment were elaborated due to the training approach.

Overall:
The TORC project has made it possible to adapt the real work circumstances and dilemmas that are recognisable for all participants of the training. By fine tuning the default strategies and resources of TORC being represented on the “placemat” (an overview of possible strategies and resources) that is provided to each trainee, a company oriented set of resources could be proposed based on the experiences in the next phase.

Without exception all trainees were intrigued, attracted to the game and after a quick start up getting used to the game. They were very committed and involved in the game dynamics and enthusiast about the dynamics, insights and peer reviews inherent to game set up. Some responses: “it was a pleasure”, “close to real life”, “not a play but real”, “evokes real challenges”, “strategies are really helping”, “within our compliance framework we have more space of manoeuvre than we know” and “good to experience operational dilemma’s again”.

The game elicited dynamics in and strategies for increasing resilience which partly differed and was partly consistent between field staff and management. The log poster (see Appendix 1) proved a useful aid to compare resilience responses in both groups. Overall the same variables were discussed during the game play. The groups differed on the way they judged the issue and the way to cope with it. In general the management group used more different strategies and resources. They embedded more organisational related possibilities to solve cope (with) the issue. In the group discussion this was also mentioned, This was supported by an after action review within the game leading indeed to important findings and valuable input for company learning. Both seniors, trainees and junior field staff and management were able to participate and cooperate in a simulated real life situation. Learning from both failures and good examples helps to strengthen the organisations resilience. The procedure to include and/ or implement the lessons learned into the organisation is a point for development.

The training method was convincing to both management and trainees asking for further use of the elements of the game as decision making and work evaluation aids which can be used on site or as tools to coach people. Examples are to use the TORC training approach for new tasks or maintenance activities. Besides to strengthen the field staff teams, a possibility is to print the game board on a table in the work preparation room at a site. Both at the start of the work or when issues occur such a table is useful for the team to think about and to share ideas and resilience related issues.

The training method and aids were accessible for a potential NAM Trainer cooperating with a member of the TORC team represented by TNO, during the pilots. Being intensely involved in the TORC development and expert in the field of resilience he was able to prepare and conduct the training by himself directly after the pilots.

The training can be organized in a variety of locations. During the pilot it was suggested to do it on an operational site and introduce more elements simulating decision making under pressure and within complex environments to bring the training even closer to reality.

3.5 Conclusions

NAM was capable of introducing and assessing the usability of the resilience concept in its organization. The company was satisfied with the quality and the outcome of the training although more specific training targets are needed for the long term follow up to keep the training content relevant and up to date.

Resilience in the context of compliance is a very relevant capability to be explored, trained and strengthened. This is also related to the domain (i.e. oil and gas industry) in which compliance to regulations via proper work preparation and provision of work permits and protocols is very strict. Onsite the unexpected situation encountered may differ from the prepared one. Training for resilience strengthens the organizational capability to deal which such situations better.

Through all sessions each work method from mock up test to pilots created awareness for strengths and opportunities to improve resilience and evaluate compliance policy and operational experience.

The open and challenging character of the TORC game set up, its gaming concept and it structure with players and observers energized participants leading to a vivid exchange of experiences, peer review and outlook for concrete follow up in operations and for training purposes.

TORC encompasses both a mental decision making loop and choices for resilient strategies. By simulating this dynamically in a serious game based on a variety of company cases several capabilities can be trained.

The prototype was considered to be as mature and capable enough to be implemented by NAM trainers in the aftermath of the pilot already.

3.6 Future prospects and developments

NAM has been capable to conduct the training with the prototype as prepared. A training program was implemented in in 2016. NAM will investigate if a possible connection can be established with the personal resilience program that NAM provides for its own personnel. Pro: it will be integrated within an existing training program, which might be a logical vehicle for implementation of the game. Con: the different goals to be achieved by these interventions might interfere with each other. A training was conduct for NAM Schoonebeek bringing together team members of a project to start a non-routine overhaul of a local installation. An imported aspect to be considered will be the embedding in the NAM-processes for safety and human resource management. Elements may be:

- Make it part of the training curriculum for field staff and management

- Explore how safety management can be made explicit in terms of space of manoeuvre for resilience capabilities
- To develop a process encompassing storytelling and after action reviews. See *Figure 6, Resilience in (left) and after action (right): a continuum*.
- To experience resilience dynamics as part of meetings and target setting of personnel development aspects and for projects.

The TORC training needs to evolve further towards more specific training targets in relation with the actual task in the field and dynamics to be simulated and to address specific competences. The TORC setup allows for the development but may require specific trainer/moderator capabilities and/or observers with a specialised background in the domain and in resilience aspects and capabilities (i.e. strategies and resources).

The knowledge and way to work as simulated by the TORC-resilience modes defend (routine), build (rekken) and stretch (strekken) in combination with the TORC-mental steps in resilient performance can be communicated in different ways to support internalization and active transfer of training results towards every day work activities. And to change behaviour of field staff and management over time resulting in a more sustained resilience performance.

The after action review can be elaborated much further for NAM, given its potential to have “tacit” experience shared and to make explicit what may be relevant for the learning organisation. See *Figure 6, Resilience in (left) and after action (right): a continuum*..As a process it may be integrated as part of the NAM safety management system. This will lead to organisational adaptation and better preparedness in the future. Implement the thinking and discussion steps from the TORC approach into practise, so the bridge between training and work environment improves. Also, these steps can be very useful for a team during work preparation to consider when something unexpected occurs in work practise. This may lead to a conclusion that job specific and more generic (resilience) competences need to be trained in depth separately.

The TORC game is very valuable to create openness and to develop a common language to discuss resilience as well as practice with issues in or out the context of compliance. Both the resilience “stretch” as well as the “decision and attitude steps” are very useful. They may be communicated through several media e.g. a table with the core of the game printed on it as a vehicle to initiate and guide a time out during operation to share different perspectives on the situation at hand or as vehicle to engage into a mutual dialogue between field staff and management (or other stakeholders) to anticipate upcoming challenges and adaptations needed to solve them.

The game challenges specific competences and a team climate to be acknowledged and strengthened further for both field staff and management. The TORC language and approach may help to structure dialogues needed in the cooperation between management and field staff. Last but not least the simulation of several practices in the game may reveal necessary strategies and resources to be developed.

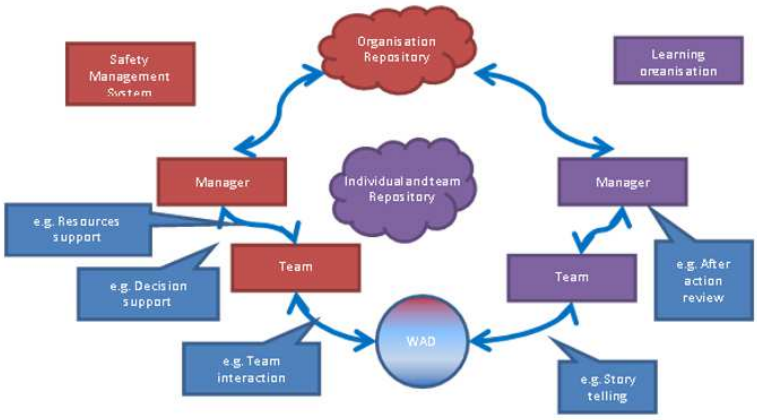


Figure 6, Resilience in (left) and after action (right): a continuum

Resilience as a concept has the potential to expand operational capabilities, but competences trained need to be supported by an appropriate policy and procedures to enable a just culture that is promoted on every organizational level. Trained and discovered needs for resources will become available than and successful resilient strategies may be stimulated. Both field staff and management will be enabled to create and benefit from an appropriate space of manoeuvre given the situation at hand and risks involved. NAM considers TORC as a new, stimulating and innovative approach well prepared to develop resilience capabilities and to be disseminated in the wider SHELL organization.

4 Close-out report of TORC Pilot Infraspeed

4.1 Short summary

4.1.1 Findings and results

- Proper elaboration about the aims, training targets and necessity of playing the game in their company before starting to play the game appeared to be necessary for field staff to be comfortable enough to actually play the game.
- If current operational practices (escalation processes) invoke field staff not to stretch operational limits beyond formal compliance then this might lead them not to cross the boundaries of routine operations. It might also mean, that if the necessary just culture is not present field staff will display social desirable behaviour during the game in line with compliance rules and regulations. Therefor it was decided that no management or staff members would be present in future field staff sessions because this might negatively influence the game play (unintentionally) in terms of inhibiting an open climate to discuss/ share or displaying actual adaptive work practices as they occur in reality.
- It is important to realize that it can be the case that the routine zone has not been defined that strong in practice which might give rise to possible ‘grey compliance areas’ in operations.
- At the beginning of the game it should be clearly stated that considerations, decisions and actions with respect to game elements (even if they lead to stretching compliance boundaries) are not reported to management. That is an essential condition to achieve a so called ‘just culture’.

4.1.2 Impact of the pilot results

- Infraspeed opened up a constructive dialogue on relevant organisational conditions necessary to create an open climate for dialogue about deviation from formal rules and behaviours expected from operations and management.
- Training resilience in the context of compliance seems to be achieved better when using customized, domain-specific casuistry, with sufficient level of detail to be able to optimally simulate the complexity of the daily working practices.
- Field staff differed in their opinion from management on whether to use mixed (heterogeneous) teams (with different functional roles or from different departments) during game play sessions instead of homogeneous teams (e.g. only track maintenance field staff or signalling field staff). Their explanation for this was that it would inhibit game players to tell or show that they stretch existing rules or procedures. Management however wants to promote the use of heterogeneous teams to facilitate cross functional learning and taking perspective of different team roles during operations.

4.1.3 Prospects and further developments

- Infraspeed is ready to implement TORC by itself. Therefor a train-the-trainer course in moderating the TORC game and its relevant resilience content essentials was given by TNO in Q3 2016. Then the game will be implemented by Infraspeed in a training program enrolling the entire workforce with the exception of some staff roles.

4.2 Introduction

The organization INFRASPEED B.V. was established in February 1999 by Fluor Infrastructure B.V., Siemens Nederland N.V. and Royal BAM Group N.V. (“together referred to as the 'Industrial Sponsors'”). The purpose of Infraspeed is the provision and maintenance of the superstructure of the approximate 100 km new high-speed rail link between Amsterdam and the Belgian border ((the Hogesnelheidslijn-Zuid (HSL-South) Project)) and is one of the Dutch pilot partners in the SAF€RA-consortium and contracted via a Consent access Industry partner. TNO set up a complementary bilateral pilot contract to agree on operational issues and output expected. Infraspeed participated in the SAF€RA project intensively and constructively.

Figure 7, one of the sites that INFRASPEED maintains

A first mock-up of the game was conducted on the 18th of November 2015 with a mixed group of field staff and management and included around six people. Pilot sessions were conducted on the 14th of March 2016 with the field staff group of eight people including two HSE staff members. And the management group with four managers and later the integrated group session with two field staff colleagues from the field staff session on the 23th of May 2016. Some pictures of these sessions are given below.

Figure 8 mock up session

Figure 9, training field staff

Figure 10, training management

Figure 11, integrated training

Figure 12 Log posters of the sessions with the same scenario and game changers

4.3 Company specific game setup and game play

The following case was used.

Case 1. KROL[2] defect

- Activities:
  Maintenance job with 3 activities at night. See outline drawing,in Figure 14
  Withdrawal of the track for service: 0:45am to 5:30 am

  Activities (see Figure 14):
  1. replacement tongue movement
  2. revising the level crossings
  3. R3 turn switches

  NVW[3] officials: 1 LWB (LWB - Leader Workplace Safety), 3 LLVs (Local Safety Leaders) and 3 TLs (Technical Leaders), 3 GMs (Tools Machinist; 1 at level crossings and 2 at tongue movement), 1 BBD (Supervisor for track that has been withdrawn for service)

  Equipment: 2 x KROL & 1 x welding coach/bus

- Situation: Track is out of service, instruction has been given. Staff are ready to deploy patches. And are waiting for call from the LWB to LLV to go to work.
- Trigger start game: At 04.00 pm the KROL of the tongue movement goes defect possibly resulting in the situation that the track cannot be delivered into service on time as well as the adjacent track as the KROL is situated with its boom in the adjacent track. At the moment it is 4.30h already with only 1 hour to go!

Figure 13 KROL defect in railway track

[2] A crane truck (KROL) can drive both on roads and rail. When driving over a the track the crane is guided by his truck. The KROL is used for all kinds of work in the track. For example, for excavation work in or along the ballast, the stabbing sleepers, making a hole with e.g. the ballast, laying of level crossing plates and putting platform walls. A KROL can be equipped with various accessories, such as a stop unit, brush container and different sizes squeeze containers.
[3] NVW stands for Normenkader Veilig Werken (NVW); The Standards Framework Safety at Work (NVW) is designed for people and organizations working with or on behalf of the railway manager (train, subway or tram) in or near the railway infrastructure which may involve collision and/ or electrocution hazard. More info on: http://www.railalert.nl/persoonscertificering/certificering/nvw-regelgeving-veiligheidstaken

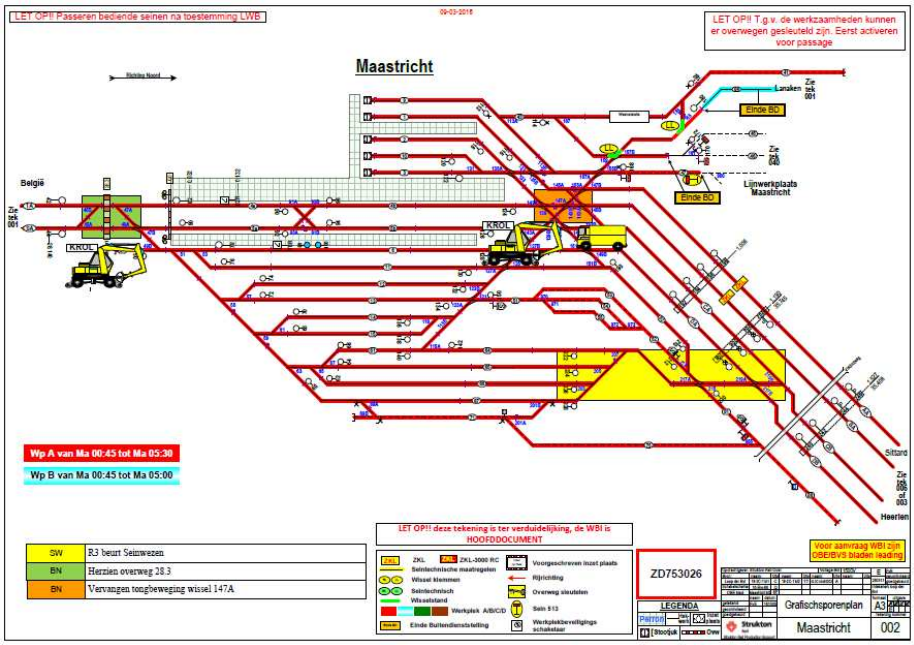
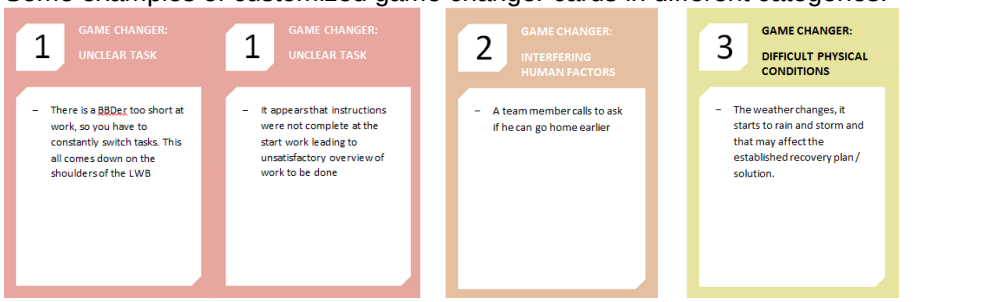
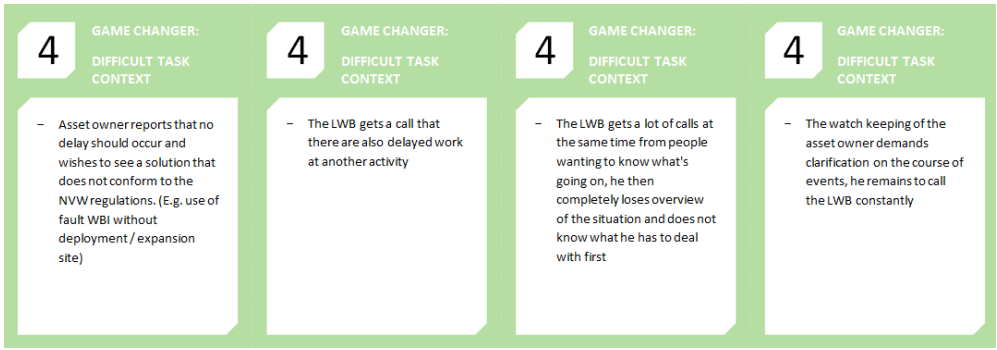


Figure 14 Case 1 work activities around the Maastricht yard/ track emplacement

Company specific cards used

Some examples of customized game changer cards in different categories:





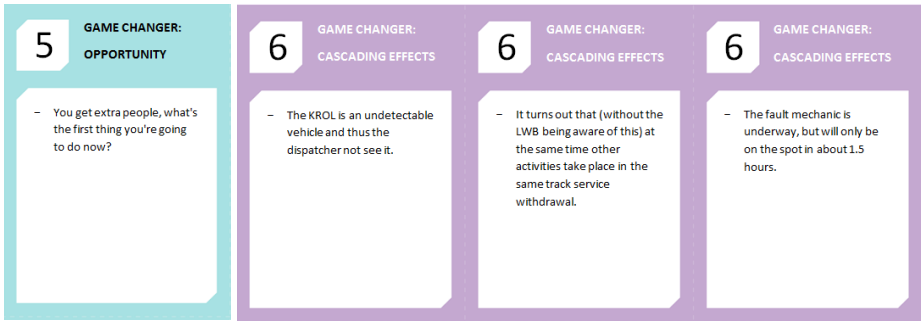


Figure 15 Game Changer cards Infraspeed

4.4 Findings

The mock up session resulted in strengthening of the game design. Several comments were made like: “the interaction during the game is very good, good catalyst for discussion / evaluation, very good tool for evaluation of an incident and feedback comes straight out of the game process”. But also there were comments like: “preferably no case which really occurred and keep case specific ingredients but less recognizable then the real case aspects”. And the use of an independent moderator preferably by a resilience expert to guide the game may also optimize the game experience.

The field staff training required more elaboration about the aims and necessity of playing the game in the company. Staff assumed that introducing the game suggested that the current level of resilience was not adequate enough. A HSE staff member explained the purpose of the game for Infraspeed accordingly which provided the field staff with necessary insights into the training targets for them to be comfortable enough to actually play the game. In general during the game play it appeared that this group of field staff members were not inclined to cross the borders of normal operational limitations (routine zone) and therefore did not or barely build or stretched during the game. Management used more different strategies and resources to solve the case compared to field staff. This could indicate that they know better within their organisation how to get support of extra resources, or that they prefer to escalate in comparison to field staff. During the evaluation of the game rounds it turned out that currently in Infraspeed it is not necessary for field staff to stretch operational limits beyond formal compliance. There are very clear process and action rules prescribed by management for when unexpected situations occur during operations. The first response appeared to be to escalate the situation to management instantly without having to decide for themselves locally what to do next. This institutionalised mechanism was reflected during the game in the sense that field staff was not pushed outside the routine operating envelop. It is expected therefore that playing the game with management will evoke build and stretch because this mostly is taking place on this organisational level. A discussion afterwards with management resulted in several observations and adjustments of the game setup toward the actual pilot session:

- The objective of the TORC training for Infraspeed will be (re) formulated and clearly brought to the attention of the game players at the beginning of the gaming sessions;
- No presence of management staff members during field staff sessions. This seems like a good decision because this might have negatively influenced the

game play (unintentionally) in terms of inhibiting an open climate to discuss/ share or displaying actual adaptive work practices as they occur in reality. The overarching goal of the training is to start the interaction between field staff and management. The integration session thus remains intact as part of the training;

- At the beginning of the game there should not be payed that much attention on building and stretching. The basis of the game is that you are just more aware of these issues at the three organisational levels: individual, team, organization. This core cannot be changed. If the goals of Infraspeed with playing the game are clearly communicated by management and conditions under which build and stretch can and should take place, and appointing field staff some examples in these categories from current practice, then that might increase the overall game effectiveness. Also, it is of utmost importance to realize that it can be the case that the routine zone has not been defined that strong which might also give rise to possible 'grey compliance areas' in operations. However, this is typically a component that should be discussed in an integration session.
- Select a pair of cases (whether or not based on reality) working with high speed line specific cases including decision making from the escalation line keeping in mind that the cases should trigger the team itself to make more decisions themselves.
- Each session should include at least one member of ITMC (traffic monitoring), one from Work Preparation, one Main supervisor and one WLV role (Work Leader Safety) and one or more field staff members. These people might be assigned the role they have in reality during the game and play the game according to those roles. The problem however might be that this does not offer a solution to the problem of diffusion of team member roles when not pre-assigning team roles to game players. Playing the game this way moves away from the idea to play with an ad hoc team were each game player (independent of his/her actual operational function) has to take the perspective of the Work Leader Safety during a game round. Playing your actual functional role limits the team interaction during the game to only a number of specific roles in which each member has certain information or a part of the solution, or experiences certain effects of the selected actions. Therefor it was decided to not assign predefined roles for the purpose of the game.

In the integrated training the use and value of the training was discussed and underlined. Managers were very committed and involved in the game dynamics and enthusiastic about the dynamics, insights and peer reviews inherent to the game set up. Although management missed certain information about the KROL case to able to play accordingly. Also, the script of the case could be even more disrupting and it was suggested to play the game with a team of mixed function roles.

Moreover, it was discussed that the practice of Infraspeed does not always let field staff and management experience adaptive challenges due to the fact that Infraspeed works to a large extent on preventive maintenance activities that are often properly planned for long before actual maintenance repair it carried out. It was therefore concluded that cases used for the purpose of the game should focus on the corrective part of the maintenance job to be most effective and interesting to the players.

The game elicited resilient dynamics and strategies partly differing but partly consistent between field staff and management. During the integration session it became clear that management was building and stretching more than field staff, see log poster as depicted in *Figure 12* and Appendix 2. The log poster proved a useful aid to compare resilience responses in both groups. Although the log posters showed a different pattern in decisions and actions taken in the defend, built or stretch zone. The discussion during the integrated training enlightened that the choices and actions taken by both management and field staff were similar to a certain extent. This might however be considered as an artefact of current work practices indicating alignment between these organisational levels in unexpected situations.

The training method was convincing to both management and field staff asking for further use of the elements of the game as decision and evaluation aid on site or to coach people. Although field staff were not all positive after their field staff training (due to the lack of action dynamics – no building or stretching - during the game), they were more positive after they experienced the guided discussion with management. Several important lessons derived from field staff experience that can improve the game:

- The KROL defect case was borrowed from Strukton and was used to test if Infraspeed workers could handle a case concerning railway operations but with respect to conventional railway maintenance instead of high speed rail. Despite the use of Figure 14 as gaming aid field staff lacked proper knowledge about a KROL and the onsite rail activities. This resulted in them falling back to basic maintenance rules and procedures. If they would have known more about the case (more details about certain technical resources and operational activities) then they would have been better able to search the discretionary leeway and authorities (i.e. space of manoeuvre) because you then also better know / are more familiar with the limits of the governing rules and procedures. It also helps to stimulate the game players more because of the added complexities and details of actual operational activities.
- Interestingly field staff differed in their opinion from management on whether to use mixed (heterogeneous) teams (with different functional roles or from different departments) during game play sessions instead of homogeneous teams (e.g. only track maintenance field staff or signalling field staff). Their explanation for this was that it would inhibit game players to tell or show that they stretch existing rules or procedures. The same holds true for the presence of a (HSE) staff member during game sessions.
- It was suggested that the use of a case from the railway domain provokes what can be called ‘railway thinking’ (meaning thinking in line with solutions and practices that are common in rail maintenance). It could be interesting, therefore, to choose a case example from a totally different domain which has nothing to do with rail maintenance to provoke more creative thinking and problem solving; e.g. from the world of sports.
- It might be considered to develop cases in which you will be less inclined or provoked to fall back to routine behaviour. For instance by using more exceptional cases. Or by introducing game changer cards that are even more focused on specific functional roles. These however should then be developed separately for different domains and can be quite labour intensive to do.

4.5 Conclusions

INFRASPEED was capable to introduce and assess the usability of the resilience concept in its organization. The company was satisfied with the quality and the outcome of the training although more specific and stimulating cases are needed for future sessions.

Proper elaboration about the aims, training targets and necessity of playing the game before starting to play the game is necessary for field staff to be comfortable enough (or have the rational) to actually play the game.

If current operational practices (escalation processes) invoke field staff not to stretch operational limits beyond formal compliance (as is the case now within Infraspeed) then this seems to lead them into not crossing the boundaries of routine operations.

At the beginning of the game it should be clearly stated that considerations, decisions and actions during the game (even if they lead to stretching compliance boundaries) are not reported to management afterwards. That is an essential condition for the game to be effective and to ultimately achieve a so called ‘just culture’ which, in turn, enables a flexible culture that promotes operational resilience in practice.

Resilience in the context of compliance is a very relevant capability to be explored, trained and strengthened. This goal seems to be achieved better when using customized, domain-specific casuistry, with sufficient level of detail is used to be able to optimally simulate the complexity of the daily working practices. This might be further enhanced by using role specific game changer cards.

All sessions, from mock up tests up towards pilot, created awareness for strengths and opportunities to improve resilience and evaluate compliance policy and operational experience.

4.6 Future prospects and developments

After the pilot sessions Infraspeed asked TNO to help them implement the training method into their organization with the help of a TORC expert that first trains certain capable people within Infraspeed to help them prepare and conduct a TORC training by themselves directly after the pilots. The results of these TORC gaming sessions will be aggregated and analysed by TNO followed by an expert advice in line with resilience thinking to management. A training program will be implemented this Autumn in 2016. Besides this there are possibilities to enrich and improve the after action review. Now this is done by reports reflecting the work as done during the shift. If resilience aspects are also reflected in the night reports, this learns the organization how to improve and to facilitate work processes and competences of the field staff.

5 Close-out report of TORC Pilot Strukton Rail

5.1 Short summary

5.1.1 Findings and results

- Strukton was capable to introduce and assess the usability of resilient concept in its organization by adapting and implementing a TORC-light version for training of 700 employees at their “Winterschool” in Q1 of 2016.
- TORC created a platform to seek a proper balance between compliance and resilience with the craftsman on the rail track in focus. Strukton promoted the TORC concept in its network and contractor chain.
- The open and challenging character of the TORC set up, its gaming concept and it structure with players and observers energized participants leading to a vivid exchange of experience, peer review and outlook for concrete follow up in operations and for training purposes. Already very soon in the mock up face several staff members were able to try certain parts of guiding the game themselves and actively tested its possibilities. And suggested changes with regard to game elements and setup.
- TORC encompasses both a mental decision making loop and choices for resilient strategies. By simulating this dynamically in a serious game based on a variety of company cases several capabilities can be trained.
- The prototype was adapted to suit the Winterschool purposes and implemented by Strukton trainers in the Winterschool for field staff.

5.1.2 Impact of the pilot results

- The pilot already elicited a diversity of resilience experiences relevant to be shared and trained even further.
- Strengthening the level of resilience by using the TORC game is a very natural way to intensify communication and cooperation between field staff and management during unexpected events.
- It opens up shared views on specific directions to strengthen operations by active team reflections.
- The difference between ‘work as imagined’ and ‘work as done’ was discussed intensively together with identifying the consequences of the experienced differences.
- Interaction between field staff and management in the training approach is a strong element of training.
- The focus on improving situational awareness and the degree of anticipation and identifying and correcting implicit assumptions about what is going on during unexpected situations might considerably improve operational performance.
- Struktons HRM department cooperated in a constructive dialogue on relevant competences and behaviours expected from operations and management.
- After a train the trainer session by TNO Strukton was able to adapt and implement TORC itself successfully during the Winterschool.

5.1.3 Prospects and further developments

- Resilience in and after action provides a space of manoeuvre for adaptive practices but needs further evolution of: safety policy, specific resilience targets, supporting system, just culture and competences for resilience capabilities.
- Develop dynamic risk management and short learning loops supported by structured storytelling and after action review and more explicit feedback loops reviewing ‘work as done’ related to resilience aspects provides input for organizational learning, coaching on-the-job and better work preparation.
- Connect learning with work and training aids to support change of behaviour, cooperation and harmonize it.
- Strukton will train relevant resilience competences in the next 2017 Wintershool based on TORC.
- Strukton experienced resilience as a very relevant capability and explores how to integrate it in its companies safety policy and Lean Daily Management debriefings.
- Strukton will organize a communication approach that improves understanding and language at all organizational levels (internal and with partners/sub-contractors).
- Resilience is seen as a crucial competence. They are willing to develop competence frameworks that helps Strukton to assess and select new personnel that are able to acquire these competences. Such profiles are enriched with the necessary resilience competences besides the job related competences.
- There are possibilities to assess the necessary space of maneuver in the contracting phase. Contract departments must be aware of the fact that personnel must obtain space of maneuver if unexpected situations arise during operations. This should be incorporated in planning somehow beforehand.
- Strukton is investigating if the TORC approach can be supported by virtual reality or virtual gaming components. If this is possible within reasonable financial boundaries they will consider this option seriously. If this is developed other companies could add their cases and exchange of cases is possible to cross-learn from other challenges stemming from other domains.

5.2 Introduction

Strukton Rail involved in rail maintenance and construction for almost 100 years. It has acquired a lot of practical rail maintenance experience and technological developments in the field of rail. The last years Strukton focusses more and more on safe working, and improving its organizational safety (culture). Strukton's clients are within Europe and abroad. Their offices are situated in The Netherlands, Sweden, Denmark, Belgium, France, Italy, Germany and Australia.

Strukton participated in the SAF€RA project intensively and constructively during the development phase. They also implemented the TORC approach and trained 700 employees during their Winterschool 2015/2016.

A first mock-up of the game was conducted on the 5th of November 2015 with a mixed group of field staff and management and included around seven people. Pilot sessions were conducted on the 11th of November 2015 with a field staff group of seven people including two staff members (one HSE, one HRM). And a management group with eight managers. At the end of the day the integrated group session was held with everybody present from both groups. The train-the-trainer session was given on November 24 in 2015. Some pictures of these sessions are given below.

Figure 16, training field staff

Figure 17, training management

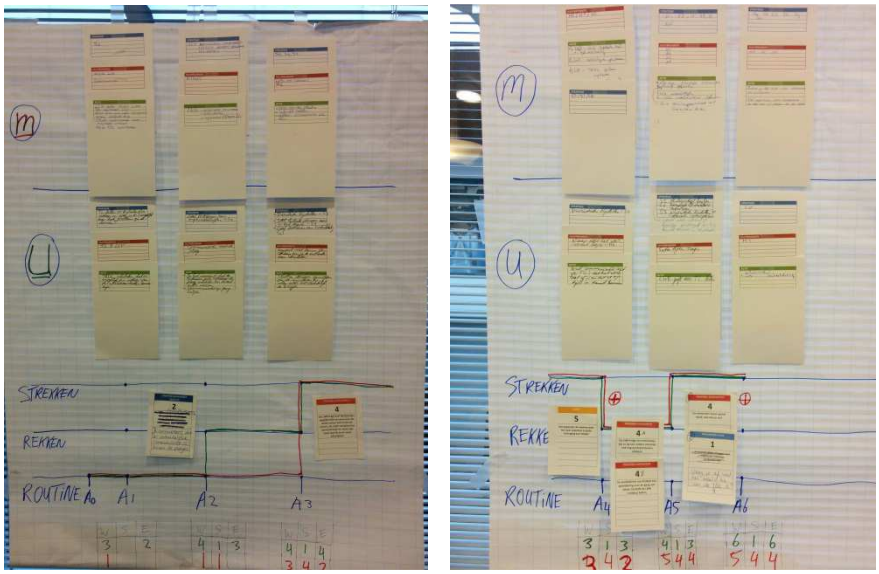


Figure 18, integrated training and log posters of the sessions with the same scenario and game changers

5.3 Company specific game setup and game play

The following case was used.

Case 1. KROL[4] defect

- Activities:
  Maintenance job with 3 activities at night (see outline drawing, Figure 19)
  Withdrawal of the track for service: 0:45am to 5:30 am

  Activities (see Figure 14):
  1. replacement tongue movement
  2. revising the level crossings
  3. R3 turn switches

  NVW[5] officials: 1 LWB (LWB - Leader Workplace Safety), 3 LLVs (Local Safety Leaders) and 3 TLs (Technical Leaders), 3 GMs (Tools Machinist; 1 at level crossings and 2 at tongue movement), 1 BBD (Supervisor for track that has been withdrawn for service), TRDL (train traffic controller), WB (Workplace Protector/ Safety Guard)

  Equipment: 2 x KROL & 1 x welding coach/bus

[4] A crane truck (KROL) can drive both on roads and rail. When driving over a the track the crane is guided by his truck. The KROL is used for all kinds of work in the track. For example, for excavation work in or along the ballast, the stabbing sleepers, making a hole with eg. The ballast, laying of level crossing plates and putting platform walls. A KROL can be equipped with various accessories, such as a stop unit, brush container and different sizes squeeze containers.

[5] NVW stands for Normenkader Veilig Werken (NVW); The Standards Framework Safety at Work (NVW) is designed for people and organizations working with or on behalf of railway manager (train, subway or tram) in or near the railway infrastructure which may involve collision and/ or electrocution hazard. More info on: http://www.railalert.nl/persoonscertificering/certificering/nvw-regelgeving-veiligheidstaken

- Situation: Track is out of service, instruction has been given. Staff are ready to deploy patches. And are waiting for call from the LWB to LLV to go to work.
- Trigger start game: At 04.00 pm the KROL of the tongue movement goes defect possibly resulting in the situation that the track cannot be delivered into service on time as well as the adjacent track as the KROL is situated with its boom in the adjacent track. At the moment it is 4.30h already with only 1 hour to go!

Figure 20 KROL defect in railway track

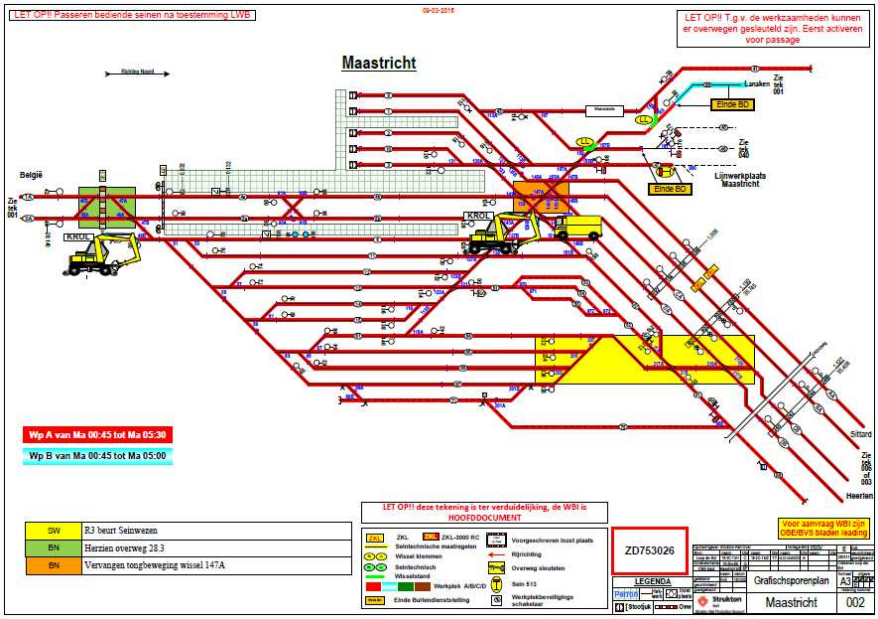
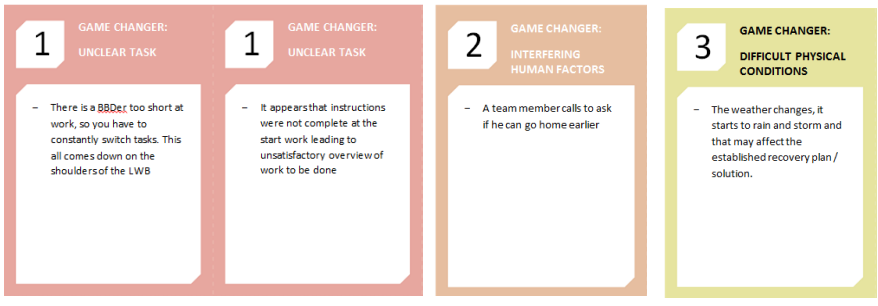


Figure 21 Case 1 work activities around the Maastricht yard/ track emplacement

Company specific cards used

Some examples of customized game changer cards in different categories:



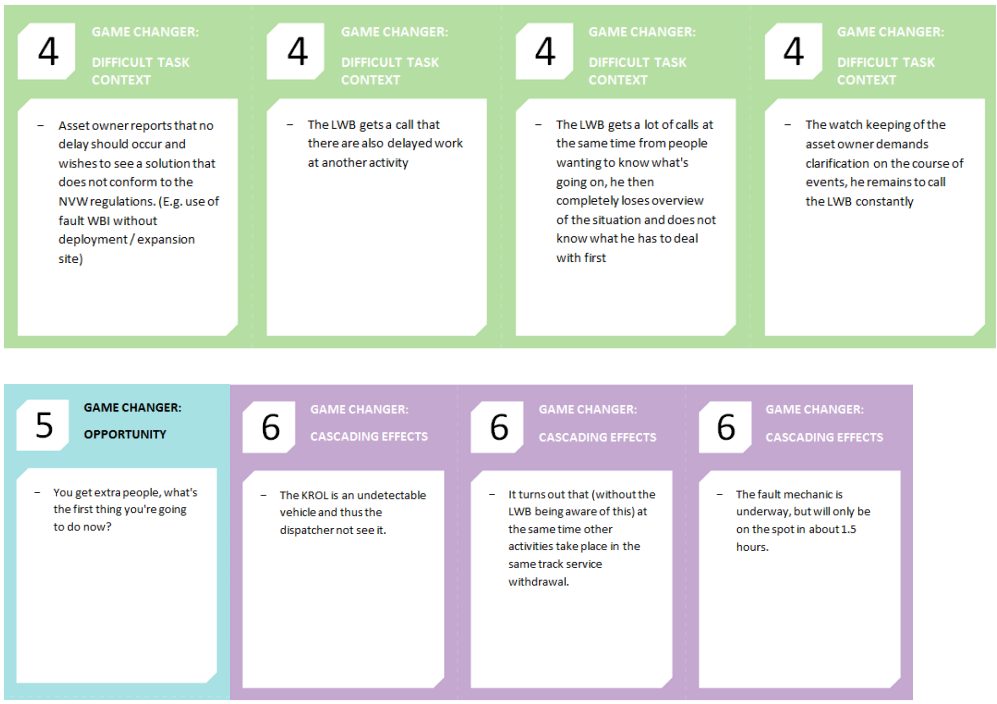


Figure 22 Game Changer cards Strukton

For the purpose of the game Strukton simplified certain cards and updated the cards with visuals (see Appendix 3). Moreover, they introduced so called 'information cards to update the teams regularly during the game to create more context and situational awareness. Some English translations are included below.

INFORMATION
The technical work on the 'tongue movement' runs according to schedule.

INFORMATION
The 'tongue movement' no longer works. Placing the new tongues movement is delayed due to the defect KROL.

INFORMATION
The work on the 'R3 turn' is running on schedule.

INFORMATION
The crossing flooring is partly out of order. Work is on schedule.

5.4 Findings

Both field staff and management groups were positive about the TORC training. During the development phase (mock-up) they were a bit reserved about the possible effects and impact. This was not the experience during the pilot phase and the Winterschool 2015/2016. Based on the TORC approach, they enriched the prototype during the Winterschool with predefined roles. This made the game play more clearly. It seemed a bit difficult for participants to keep their role during playing the game. During the training sessions they gathered remarks and problems fieldstaff operators experienced. These were gathered by trainers on flip overs hanging in the training class room and handed over to the organization afterwards. The management had to respond on those remarks in a session later. During the evaluation session it became clear that although managements intention was to respond rapidly, it was difficult to follow up the remarks made during training sessions by clear management statements. A possible effect could be that employees are not willing to respond the next time if management stays passive regarding their input.

During the pilot phase participants/trainees and observers were intrigued by the setting and task facilitated by the TORC training. They did not thought it was possible to challenge themselves and management by the training and the implemented game technology. In the pilot training sessions it was necessary to explain the roles to the participants during training and not let the observers interfere during game play, and sit on their hands. The interaction during the training worked contagious and needed some steering by the training staff.
The overall evaluation of the TORC training pilot was positive. The field staff, management and integrated training session led to a vehicle to open up the interaction between support & facilitation and actual work experiences regarding resilience. The chosen approach to led both management and field staff cope with the same cases worked out fine. It made discussion afterwards meaningful and paves the path for company improvement. One remark regards the reaction and the company policy management has to converge their respond. In the integrated session several different responds were made by management regarding the

questions and remarks field staff made. This could evolve into misconception and misunderstanding or even failure.

During the pilot the following patterns emerged between management and fieldstaff training (more detailed information can be found in Appendix 4).

Modes of resilience through game course: both fieldstaff and management first stay in the defend zone but from Action 3 on fieldstaff starts building up resilience but both teams stretch their position during Action 4. After returning to the build zone due to an opportunity arising (machine working again) both teams end up in stretch position again. This might have been an artefact of two events (game changer cards) introduced at once.

Strategies used: Overall it is noticeable that field staff deploys fewer strategies during playing the TORC game then management. 1. 'Adapt work process' 2. 'Add human resources', and 3. 'Prioritize' are used most by both teams. When stretched to the max. management seems to use more strategies to control the situation at hand to prevent the system breaking down. And they use different strategies then fieldstaff during stretch situations (i.e. Reallocate resources, Seek active reflections, Appoint team & info lead, Create liaisons); they seem to have or create more oversight.

Resources used: Fieldstaff seems to primarly use 'People' and 'Assets' while management makes more use of Information, Communication and People during the game.

Approach taken: Interestingly both groups inform the TRDL (train traffic controller) but don't seem to have much eye for the situational awareness of the TRDL. Management shuts down work during Action 4 to create oversight and prevent risks. Fieldstaff has not shut down the work during any of the action rounds despite the fact that they have this option (in real life) at their disposal. Also, management consults and informs more people in the 'system' during different action rounds (i.e. WB, LLV, TL, etc.).

Investments: Workload is rated higher by fieldstaff during the game although workload increases for both teams steeply after Action 4. Overall management seems to see more risks for safety during the different Actions. Also, fieldstaff seems to be more aware of consequences of disruptions for reaching production goals (efficiency).

5.5 Conclusions

Management and fieldstaff had similar stretch, build and defend pattern.

Overall it can be said that management used a wider variety of resources (i.e. additional information and communication with other stakeholders) and (more) strategies (i.e. adapting the work process, prioritization of work, seeking active reflection and creating a liaison) then fieldstaff did.

Fieldstaff seemed more oriented towards using additional technical assets, materials and involving and communicating with technical track maintenance people like the Technical Leader.

Management seemed to be informing the TRDL (train traffic controller) more regularly about the status regarding the situation on the track than fieldstaff did (only at the start of the delay).

Fieldstaff very soon after the first two game changer cards seemed to experience more workload. Also, management rated the rising unexpected events to have more (possible) negative effects on safety than fieldstaff did.

The game opens up shared views on specific directions to strengthen operations by active team reflections. The focus on improving situational awareness of multiple parties in the system (including train traffic controller) and increasing the degree of anticipation and identifying and correcting implicit assumptions about what is going on during unexpected situations might considerably improve operational performance. Fieldstaff seems to focus more on getting the work done (action and solution oriented). The active mental loop incorporated in the TORC game more or less 'forces' them to step back during the event to spent a little more time on assessing the situation first and exploring possible strategies and resources to implement to resolve the unexpected situation at hand.

Strukton was capable to introduce and assess the usability of resilient concept in its organization by adapting and implementing a TORC-light version for training of 700 employees at their "Winterschool" in Q1 of 2016 after the pilot.

5.6 Future prospects and developments

Strukton will train relevant resilience competences in the next 2017 Wintershool based on TORC. Resilience is seen as a crucial competence. They are willing to develop competence frameworks that helps Strukton to assess and select new personnel that are able to acquire these competences. Such profiles are enriched with the necessary resilience competences besides the job related competences. Furthermore, Strukton is investigating if the TORC approach can be supported by virtual reality or virtual gaming components. If this is possible within reasonable financial boundaries they will consider this option seriously. If this is developed other companies could add their cases and exchange of cases is possible to cross-learn from other challenges stemming from other domains.
Strukton will also explore how to integrate TORC game elements (TORC bord, evaluation and reflection questions from debriefing format) in its companies safety policy and Lean Daily Management debriefings.

6 Evaluation of the training results

In Deliverable D5.1 of the TORC project it was described that the this project will use Kirkpatrick's (1994) evaluation framework for evaluating the TORC game which has four distinct levels, which we use to assess resilience interventions or resources:

1. Reaction - Assessing impact through the elicitation of perceptions and attitudes from the participants in the TORC training
2. Learning - Assessing impact through the elicitation of new knowledge, skills and learning from the participants in the TORC training
3. Behaviour - Assessing impact on the behaviour from the participants in the TORC training
4. Results - Assessing impact on the results that the organisation uses to evaluate its performance

Given the scope and duration of the project itself it was only feasible to assess the first two evaluation levels immediately after training by using the TORC Evaluation Questionnaire (Appendix 1, see D5.1 report). Moreover, since all companies currently are exploring their next steps on how to use the game (concepts and/ or elements) in a more structural way and one is implementing the TORC game within the whole company while writing this report it did not seem feasible to assess the other two levels during this project. However, the questionnaire for level 3 and 4 is available at the moment for companies to assess at a later stage.

Although we distributed the TORC Evaluation Questionnaire in all pilot companies we only received enough response from NAM employees (N=14) to perform basic statistics that actually are informative enough with regard to TORC training effectiveness on Level 1 and 2. IMBV and Strukton only returned four questionnaires each which is not nearly sufficient for analyses and meaningful insights. Therefor it was decided to discard them completely from analyses. Only NAM results are described below.

TORC Pilot NAM
Within NAM 14 respondents replied to the TORC Questionnaire which counts for a 50% response rate. A more detailed overview of the results can be found in Appendix 5.

With regard to the degree to which participants liked the TORC training and believed it would help them with their job, the degree to which participants are actively involved in and contributing to the learning experience (engagement) and the degree to which training participants will have the opportunity to use or apply what they learned in training on the job (relevance) most participants of the training (i.e. reaction) agree that the TORC game does all that. One respondent does not think that is will be easy to integrate the training content in her/his daily work but does not give any further explanation. Interestingly enough four people say that the training is in conflict with existing procedures. And almost half of the respondents (6) are 'neutral' when it comes to if the training will actually improve their job performance in applying the training content in practice. Most respondents say that

the training makes them reflect on their role in ensuring the safety of the operation. And that the training reflects operational realities of their job.

With regard to the degree to which training content was acquired by the trainees and the degree to which participants acquire the intended knowledge, skills, attitudes, confidence and commitment based on their participation in a training event (i.e. learning) it appears that with every question one or two respondents disagrees with the statement. And a lot more seem to be neutral in their answer with different statements. Too bad that we have not obtained any additional comments which give us more insight into why this is. The game seems to have helped respondents to increase their awareness of their personal role to ensure resilience and taking perspective on difficulties people with other roles experience during unexpected events. And how everybody contributes in keeping the system safe and resilient. Moreover, they have learned how to better react to, anticipate and learn from unexpected events. A lot of respondents do not feel more responsible for their part of the operation (3) or are neutral to this statement (6). And most respondents have learned to reflect and evaluate how positive and negative experiences with resilience in practice contribute to improving the operation. Also, most have learned to reassess the mandated decision making space with the space of maneuver they need during unexpected situations or circumstances during work.

No comment fields were added to the questionnaire which resulted in missing additional information on several scores. The TORC evaluation questionnaires should be complemented which such sections in the future.

7 Discussion

7.1 TORC training: content, format and game dynamics

In all Dutch industrial settings the training worked satisfactory. Both field staff and management were able to deal with the cases to assess them according to the pre-defined steps and cope with the problems. The groups differed in the way they acted, but registration of the choices on the log poster made it possible to discuss those choices and the used strategies and resources. Nevertheless it seemed difficult to trace the choices made by the training group because the notation of the choices were not consistent. Some groups noted only the numbers related to the placemat with resources and strategies, others wrote down their choices in wording not without numbers. Analyzing those outcomes is only possible if it is done directly after the session. A recommendation is to improve notes by using ICT support tools.

Moreover, writing down the teams considerations by the training participants themselves while playing the game somehow seems to inhibit game play. Mostly they don't seem to be used to do so in practice to. For the purpose of the game it seems advisable to let one trainer track the teams elaborations during the different play rounds to get a more accurate report of what happened and which choices are made why during the game including observation reports by the team observers. However, this is only interesting and important when you want to advice the organization afterwards about patterns in strategy and resources deployment by the teams when fully implementing the game throughout the organization or department(s). For direct evaluation after a TORC training the training moderator should be able to reflect on the game play (team dynamics and strategies/ resources used) sufficiently based on what he saw, heard and what is described on the log posters.

Further study is needed to explore what task specific and generic competences could be enriched by behavioral characteristics (and strategy use) which enhance resilience. One participating industrial partner currently investigates this topic for further strategic competence development of its employees. This requires a more in depth study on the mechanisms that enable and sustain resilience performance over time. One of the first steps might be to further customize the existing resilience strategies and resources towards operational and strategic practices in line with their current organizational standards.

It seemed relatively easy to let in company trainers acquire the necessary competencies to facilitate training. After one or two training sessions the TNO support became less and the in company support increased. This was before training sessions started one of the requirements, to let industrial partners themselves be the moderator and facilitator of resilience intensifying activities. The overall three level approach: field staff-; management- and integrated training played an important role in increasing resilience as a vital aspect of operational excellence. The training levels led to discussion and learning at the level they normally act during work. Moreover, it feeds discussion between their own and other level's experience. This could support organizational improvements.

The way the learned competences are transferred to the work environment also depends on the job aids or instruments used to bridge the learning environment and transfer of training towards the work environment. Some examples that were discussed with industrial partners during the close out sessions were: stand tables in the canteens field staff could use to discuss for start work, with problems or issues. Moreover, in the After Action Review questions related to the teams resilience performance are asked to encourage teams to systematically review their work more often and to let other teams in their organization to learn from their experiences; both examples of successes and failures are input for such reviews to improve overall organizational learning.

An important enabler for the training was to choose and analyze relevant cases. In the beginning this was a difficult aspect: what cases are needed? Furthermore, often only examples of failures are recalled or remembered and mostly it appeared to be quite difficult to come up with the examples of successful performance. Let alone that they knew why these cases were successful. The case descriptions formed a crucial element in the training. The setting and constraints were depicted as a starting point for the game play. The TORC approach could be used for analyzing new cases (based on positive and negative experiences of resilience in everyday operations) and produce more cases that can be used for future training purposes. The pilots showed that it seems appealing to also use cases from other industries (i.e. rail maintenance teams using a case from chemical plant operators) but our experience shows that such cases make it more difficult for teams to relate to such cases if they miss the actual details of operational activities and its operational context to be able to play the game and to achieve the TORC training goals as intended.

The training is implemented, before the project has finished, within two industrial partners. One used the training during their Winterschool program (winter 2015-2016). The other partner has trained his personnel end summer-autumn 2016. The benefits of the training is seen by the involved key players in the involved partner organizations. Not all training variants were focusing on the interaction between management and field staff. The way personnel is judging the training approach differs from very enthusiastic, ‘it helps a lot’ – to – this is nothing new ‘we work according to this’.

7.2 Organisational preconditions

As a result of piloting the game in different organisations we identify several overarching elements that appear to be key sources for a successful implementation of the TORC game in companies. A more detailed elaboration is given below on each element and will result in an integration of these elements at the end describing a new risk management approach which includes resilience.

7.2.1 Organisational structure as a resource: balancing organisational stability and flexibilty

The most difficult aspect which is touched upon during the TORC training is the relation between adhering to prescribed rules and procedures (need for organisational stability) and the space of maneuver that is needed for resilient performance during operational activities (need for organisational flexibility). In most

companies this seems to be a tough topic especially for management. This is an interesting observation. Within Europe (and consequently its member states) the legislation in the field of working conditions does not contain so prescribed risk management regulations anymore but provides so called goal prescriptions that must be met in relation to occupational health and safety. So there is room to choose as a company for a risk control measures that provide an equivalent level of control as existing best practices in an industry or sector. However, certain branch organizations like in the rail sector still prescribe a considerable amount of rules in vast detail even up to complete job prescriptions for different (technical and safety) job positions (i.e. Normenkader Veilig Werken (NVW) as described in footnote 3). And companies within this sector are obliged to adhere to such compliance frameworks which limits their freedom to choose other risk control measures quite extensively. Making such rules more flexible (meaning providing room for resilience in the context of compliance) requires changes that must be initiated on branch level by different stakeholders. The premise of the management then seems to be that field staff is supposed to continue to operate in the routine zone regardless of what is happening. The current (escalation) procedures are perceived as good enough to cope with unforeseen situations in practice. And may be operated at all times. In the eyes of management this process guarantees the overall stability and reliability of the current operational activities. Because this practice over the years has resulted in preventing any incidents or accidents from happening management seems to be strengthened in this line of thought. Although this line of thinking might be legitimate based on operational experience and outcomes up till now it might still limit overall organizational resilience capabilities at the field staff level when procedures cannot be properly enforced when necessary in unexpected situations. This dilemma has is elegantly depicted in Figure 23 below.

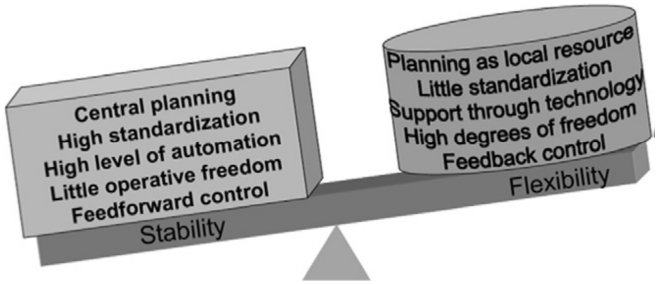


Figure 23 Balancing stability and flexibility by management of uncertainty (Grote; 2007a, 2012)

The organization can generally cope with uncertainty reduction in two ways to exclude risks as much as possible: (1) minimizing uncertainty vs. (2) dealing in a competent manner with uncertainty (increasing capacity to deal with uncertainty by all actors in the organization). Resilience Engineering addresses especially the latter based on the idea that if the operating conditions entails (lots of) uncertainty or unpredictability (as for example may be the case in maintenance activities) more will be needed to adapt flexibly to the circumstances. This can be done by giving field staff more room to independently deal with this uncertainty in order to proceed on the basis of expertise (e.g. by delegating decision making powers lower in the organization; using disturbances as opportunities for competence development and for system change). And by promoting operational autonomy (e.g. participatory design of the rules and procedures they have to work with) rather than to prescribe

everything in detail by using stringent action rules and procedures. Or by providing tools to support decision-making (decision support systems, objectives and process requirements) during unexpected situations. And give more opportunity for optimal collaboration and mutual learning. There are however practical reasons in some situations to choose to minimize uncertainty e.g. if there is a need for traceability of decisions (due to legal or administrative liability), there is only a low error tolerance acceptable (e.g. compliance to so called Life-Saving Rules[6]), there are closely coupled (technical) systems, or where the qualification or competence level of employees is low with respect to the risks associated with the type of work. Grote (2004b) sees a proactive culture as a solid basis for coordination and integration of both approaches, balancing them through loose coupling in line with Weicks principle (1976). In practice, the organization will have to find a balance between the two risk management strategies depending on the risks that it faces in the practice and its organization and specific work and business processes. The focus within the TORC training is on increasing of the resilience of teams in the operational implementation of the work within the context of compliance.

7.2.2 Just culture as a resource

At the beginning of the game it should be clear that considerations, decisions and actions with respect to game elements (even if they lead to stretching) are not reported to management. That is an essential condition to achieve the returns from the game if you want to retrieve information from the field staff that are not (always) known or reported to management (read: shortcuts, other working methods, etc.). If you want to achieve this there must be mutual trust that deals with that information in a just or fair manner (so called 'just culture'; see Figure 24 in which just is described as one of five characteristics of a safety culture). There is a scientific debate about whether to use the term 'just culture' because it is seen as an artefact of the blame culture / Safety-I view (i.e. traditional safety management; Hollnagel, 2011[7]).

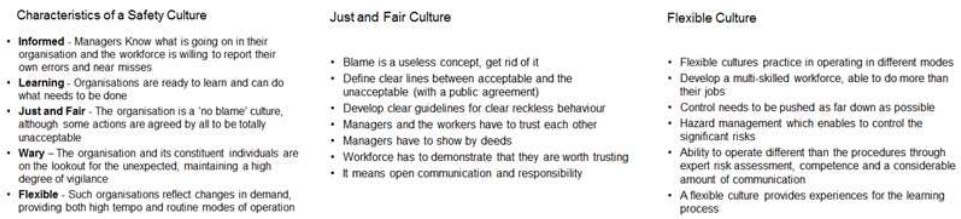


Figure 24 Characteristics of a safe culture (Reason, 1998)[8]

Instead one should talk about a 'fair culture': "a culture that recognizes that work is based on performance adjustments, and that this is so whether things go right or things go wrong". Although this is an interesting line of though we merely want to stipulate the importance of having a just or fair culture. In our view both concepts overlap and should both resolve the potential and actual conflict between work as imagined (or prescribed by rule or design) and work as done without blaming any individual. Interestingly, a fair culture is first and foremost an issue for management, although it of course also must be subscribed to by everyone in organization. Also,

[6] Shells 12 Life-Saving Rules http://www.shell.com/sustainability/safety/personal-safety.html
[7] Hollnagel, E. (2011). Just Culture vs. Fair Culture. Retrieved from internet on 11 November 2016 on http://erikhollnagel.com/onewebmedia/JustCulture_FairCulture.pdf
[8] Reason, J. (1998). Achieving a safe culture: theory and practice. *Work & Stress*, 12, 3, 293-306.

Figure 24 describes other cultural attributes like flexibility and learning which are seen as important elements to enhance resilience. All these elements (flexibility, just and learning culture) are also addressed by Wreathall[9] (2006) as principles of a culture that promote resilience ((together with top-level management commitment, awareness of and preparedness towards – problems related to - human performance variability and erosion of safety barriers (using leading indicators) and opacity[10])). In Figure 25 it is shown how all the key characteristics of a highly reliable safety culture are connected with each other.

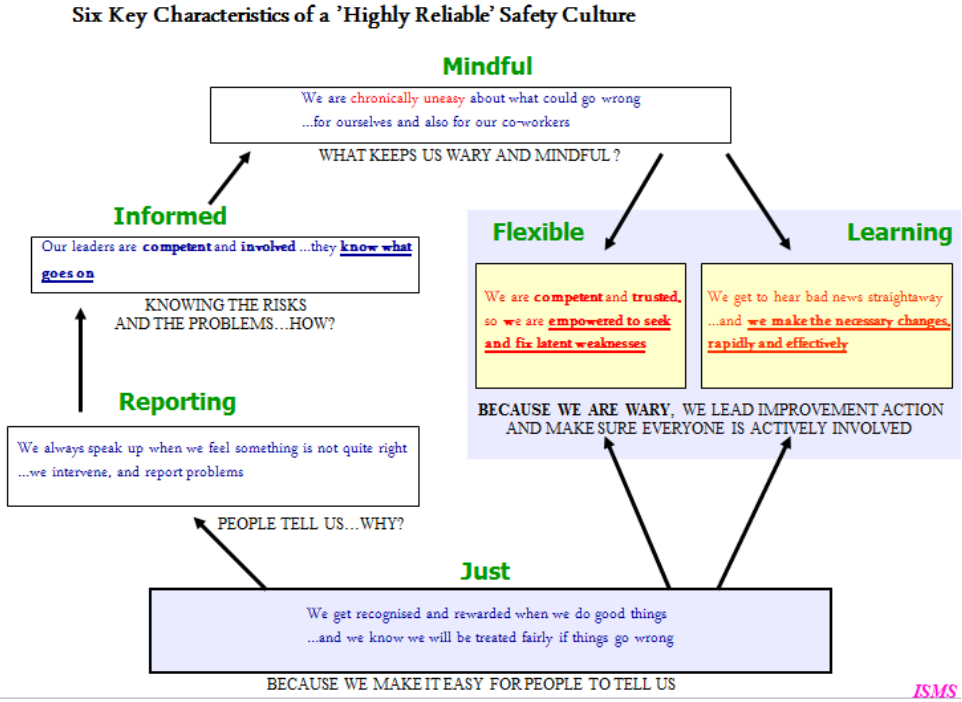


Figure 25 Connecting the six key characteristics of a 'Highly Reliable' Safety Culture (Hudson, 2008)

It cannot be that due to playing the TORC game employees are punished or negatively addressed afterwards. That will result in losing confidence in one fell swoop. More important is it to ask the question: why does field staff take shortcuts, use other methods of work, adapt formal rules, etc.? And what can we do as an organization about it, where do we draw the line and why? The intention of the game is to initiate an open dialogue to increase informedness on all organizational layers (i.e. transparency) to ultimately improve operational performance and resilience. If you're going to draw boundaries than the process of how you should handle non-compliance must be thoroughly formulated in a 'just or fair culture' policy document. See the example in Figure 26 below from Patrick Hudson[11] as an initial guidance with key steps that must be addressed in such a policy statement. It becomes clear from this figure that every organizational layer has a role to play to

[9] Wreathall J. Properties of resilient organizations: an initial view. In: Hollnagel E, Woods D.D., Leveson N., eds. Resilience engineering: concepts and precepts. Aldershot: Ashgate, 2006:275–85.

[10] the extent to which the organization is aware of economic pressure (budget cuts), workload and pressure on safety and the extent to which they need to make efforts so that related safety barriers are not broken

[11] Picture retrieved from a presentation of Patrick Hudson: Achieving a Just and Fair culture – making the ISMS work (24th of January 2008)

achieve a solid just and fair culture. If the just culture policy is absent or not defined very well within a company that is an important first step to improve on if one wants to achieve a flexible culture that enables resilience.

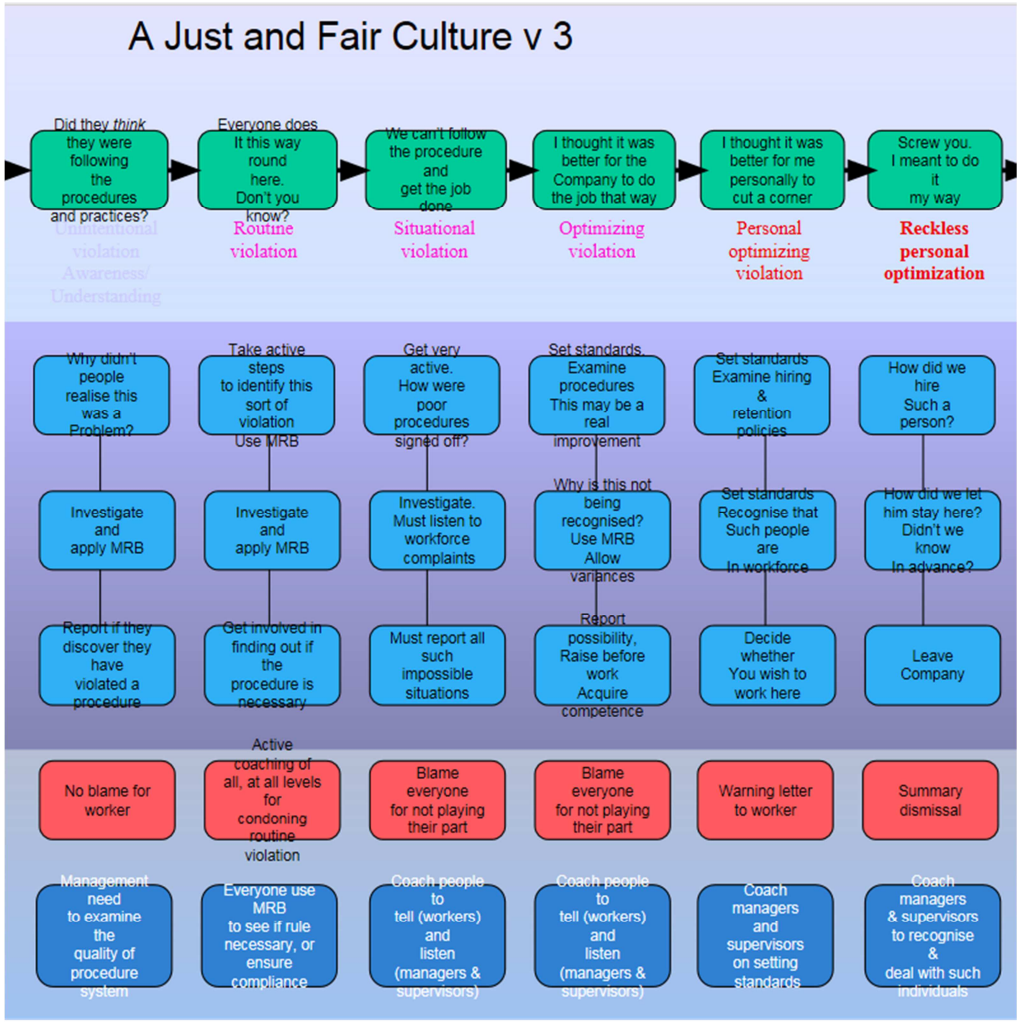


Figure 26 A just and fair culture (Hudson, 2008)

Despite organisational limitations in dealing with existing rules and regulations or current just and fair culture maturity one can still start discussions within its company by using the TORC game that helps to set the scene for operating more resiliently, and to improve interaction between management and field staff in general, about operational processes and risk management, work preparation, autonomy, management and field staff responsibility in ensuring the necessary space of maneuver for field staff that enables them to perform operational activities resiliently under changing conditions while still being able as managers to ensure control over operational and supporting processes in such a way that incidents don't happen (mandated space of maneuver).

The game brings anchors to use more or different strategies and use resources that are already available within the company. This process of facilitating interaction between organizational levels and improvement of operational excellence is only possible when the necessary cultural requirements are available. In those cases where field staff hesitate to react or discuss a lack of resilience (or existing

improvisation practices) with management with regard to what actually happens during work activities (work as done vs. work as imagined) and not being able to initiate an open and transparent dialogue about this (looking for ways to collectively negotiate the space of maneuver) will inhibit organizational growth and resilience capacity in the end. When the organizational cultural supports and open and transparent climate in which employees are encouraged to share their positive and negative experiences gives the organization options to grow and improve performance. When initiating a TORC project within a company one should be very alert to the cultural context. One could either encounter it during the project or might even consider to assess the cultural maturity before implementing the game. In some cases the climate is robust enough for HSE and management to blend with field staff in collective sessions but in others it seems more wise to first start to train groups separately to build the necessary trust before integrating organizational disciplines.

7.2.3 The learning organization as a resource

Two aspects appeared to be important to learn adequately and effectively as an organization as part of the TORC training (remember the process as described in Figure 6). First, the organization must have implemented a rigorous process to allow actual organizational learning from successes and failures to take place. A learning from incidents process must be correctly implemented; from inventory to implementation and evaluation of effectiveness of improvements (Drupsteen et al., 2013). And secondly, it must ensure that the people themselves in the organization learn from experience and information based on incident investigation and analysis is actively used (Lukic, Margaryan & Littlejohn, 2013). An organization that only disseminates such information within the organization is a feature of single-loop learning (Gordon, 2008). Generally these points seem to be a problem within companies to implement correctly and also hold true for informal learning that took place during the TORC game because these experiences must be transferred to the formal learning process the company uses to boost the learning organisation. Also, more in-depth research on organizational and system factors aimed at actually changing the system by learning from incidents/ experience is a property of "double-loop learning". An essential element here is the involvement of all organizational levels: the individual, team and organization (Koornneef, 2000). If only learning takes place at the level of the individual or team (and therefore the organization as a whole does not learn of incidents/ experience) the organization remains vulnerable for re-recurrence of certain incidents (Argyris & Schön, 1978 & 1996). So-called 'triple-loop learning (Argyris & Schön, 1974) even refers to changing learning in a dynamic environment with an approach to rethink underlying conceptions raises and behavior arising therefrom (i.e. transforming the organisation, this is the real reform within the company that recognizes the necessity of resilience in the context of compliance). In Figure 27 all three forms of learning are modeled.

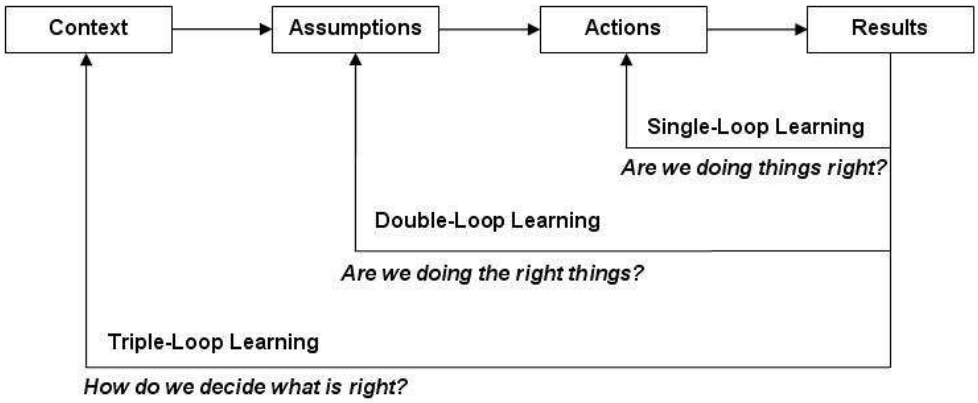


Figure 27 Model of system levels of learning (Argyris & Schön, 1974)

7.2.4 Resilient risk management

All elements described above are necessary preconditions to enable resilience to flourish in organisations based on our experiences with piloting the TORC game. Figure 28 below tries to connect culture, organisational structure and learning with the resilience capabilities trained for in TORC (i.e. four cornerstones of resilience; Hollnagel, 2011a) as important building blocks and shows how existing risk management approaches (i.e. safety management, safety culture) can be integrated with new risk management approaches (i.e. resilience risk management) to enable sustained adaptive performance.

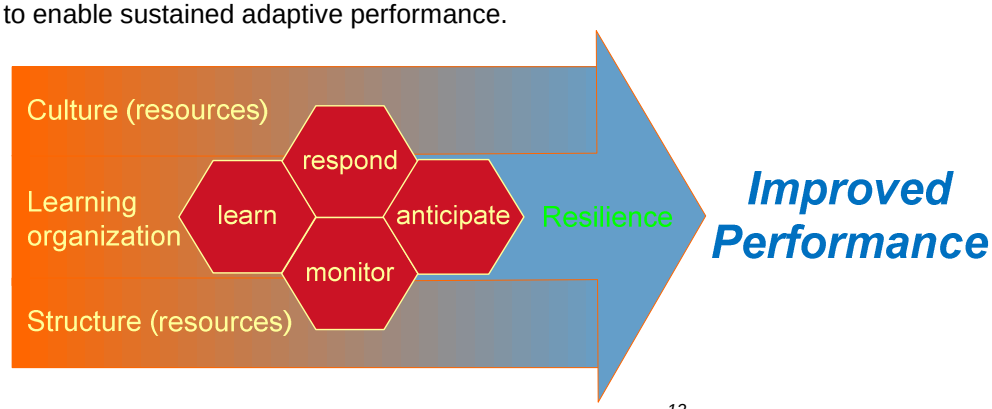


Figure 28 TNO approach to Resilient Risk Management [12]

[12] Dolf van der Beek, Niek Steijger en Johan van der Vorm (2014). Rapportage onderzoek Veerkracht Teams Nufarm. TNO 2014 R11812

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9 Signature

Leiden, 11 November 2016

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Signature:

F.A. van der Beek MSc
Projectleider

Autorisation release:

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Research Manager

Appendix 1 Log poster NAM Pilot: Case Compressor maintenance

Game Changer Cards	Case intro		Due to traffic jam a maintenance crew has not arrived yet at moment of start work		Due to massive protests of environmentalist at the gate operators expected to arrive are not able to enter the plant		The operator who would work towards the planned safeguarding is called away because of a priority at a different location		The valve was provided for the safeguarding turns out not to be leak proof. There is an alternative valve available at 2.6 meters which is not accessible through the normal platforms		There is a leak in another part of the installation allowing natural gas condensate to occur and threaten to flow		x	
Team	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**
Stretch						x				x				
Build	x	x	x	x			x	x	x			x		
Defend					x									
Case 1 Compressor maintenance	**Action 0**		**Action 1**		**Action 2**		**Action 3**		**Action 4**		**Action 5**		**Action 6**	
Team	F	M	F	M	F	M	F	M	F	M	F	M	F	M
Strategies (S)														
1. Adapt work process									S1 a					
2. Add human resources														
3. Prioritize					S3 a,b									

4. Understand what you see 5. Seek active reflections 6. Reallocate resources 7. Seek different viewpoints 8. Share learning 9. Appoint team & info lead 10 Create liaison			S4 c S7 a,b	 7		4 10	S6 a,b	6	S10 a				
Resources (R) 1. Information 2. People 3. Assets 4. Time 5. Communication			 4a	1 4 5	 4a	2b	2i	2 5	1a, 1d, 2c, 2g, 4a				
Approach (A)													
Continu with preparation			x										
Deploy safeguarding; Safeguard sneak in with contractor; Toolbox				x									
Not starting yet;; consult due to demonstration "					x								

Await duration of demonstration, no go/go??; postpone safeguard, on hold						x								
Transfer safeguarded situation to another operator with the same competence							x	x						
explain situation to team leader and ask permission; let a scaffold be placed; pressure testing, see if its not releasing									x					
arrange scaffold; use stairway										x				
Shutdown activities												x		

Investment														
1. Workload			1	1		2	1	3	1	4		4		
2. Safety			1			1		1	1	2		3		
3. Efficiency			1		2	2		3	1	4		6 (all fiches spent)		

F= Fieldstaff
M= Management
Action = Game round

Appendix 2 Log poster Infraspeed Pilot: Case KROL Defect

During training the first session with fieldstaf was not as structured as with management. The case introduction was not introduced the same way. Therefore the game changer cards diver. First the idea was to evolute the game play according the choices made by the team. Later trainers decided to script the game changers what resulted in more challenging interactions.

Game Changer Cards	Case introduction Case intro Krol defect		Nearby a crane falls on the rail track The equipment fails and stands still on the rail track. Possibility work delays and track is not ready in time		The weather gets bad: rain fall and stormy. It might affect the work Nearby a crane falls on the rail track		Although safety measures were taken power gets free The weather gets bad: rain fall and stormy. It might affect the work		The equipment fails and stands still on the rail track. Possibility work delays and track is not ready in time Although safety measures were taken power gets free		The malfunction engineer is on his way, but is delayed. He will arrive not earlier than 90 minutes The malfunction engineer is on his way, but is delayed. He will arrive not earlier than 90 minutes.		The Dutch rail manager Prorail states that the rail track must get back in order in time The Dutch rail manager Prorail states that the rail track must get back in order in time	
Team	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**
Stretch										x		x		
Build		x				x		x						
Defend			x	x	x		x		x		x		x	
Case 2 Exchanging pump unit	**Action 0**		**Action 1**		**Action 2**		**Action 3**		**Action 4**		**Action 5**		**Action 6**	
Team	F	M	F	M	F	M	F	M	F	M	F	M	F	M

Strategies (S)																		
1. Adapt work process							S1 Tel info	S1a goal is cleaning up		S1a Make situation safe								
2. Add human resources										S2a Installation expert		S2c Special ??						
3. Prioritize										S3b Let other level/person decide what to do		S3b Hand over tasks to special forces						
4. Understand what you see						S4a What does new incident mean		S4b redistribute tasks within team										
						S5b Escalate to management												
5. Seek active reflections																		
6. Reallocate resources																		
7. Seek different viewpoints																		
8. Share learning																		
9. Appoint team & info lead										S9a pinpoint person		S9a Decide what to do on location						

10 Create liaison			10a		10 contact WLV		10a	S10a Call for decision	10 a inform GM necesarry interventi ons TRDI possibiliti es and tools needed		10a		10a	

Resources (R) 1. Information		1g Are we done				1c brief situation		1b work instructions disturbances					
2. People		2a assessment KLOR			2a expert on the spot		2a expert on the spot 2b HSE		2f BAM material	2a Add teamleader 2b assess safety 2f	2a 2c	2a 2c let experts decide 2f manager	2c escalate Manager duty
3. Assets												3a Arrange other krol to improvice	

4. Time		4a extra time via LWB									4a extra time			
5. Communication			5a			5b		5b What is decision						

Approach (A)		Remove Krol Expert contact	start		Keep on working		PL desides what work/tasks could go on		Inform if work may delay		??		maintain Situation , solve problem with crane later	

Investment														
1. Workload				2		1	1	1	2	1	1	-1	1	
2. Safety					1		1	1		2	2			
3. Efficiency			1	1	1	1		1	1	1	2	1		

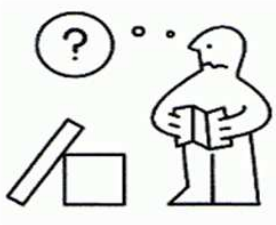
Appendix 3 Example Game Changer cards Strukton

Verstoring 1

Er is een BBD'er te weinig op het werk, waardoor je constant moet wisselen van taak. Dit komt op de schouders van de LWB terecht.

Verstoring 2

Het blijkt dat de instructies onvolledig waren aan het begin van het werk en daardoor onvoldoende overzicht op de activiteiten van het werk is.

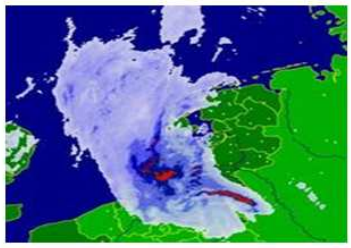


Verstoring 3

ProRail meld dat er geen vertraging mag ontstaan en stuurt aan op een oplossing die niet conform is aan de NVW regelgeving. (bijv. gebruik van storings-WBI zonder inzet/uitzetplaats).

Verstoring 5

Het weer slaat om, het begint te stormen en regenen en dat heeft mogelijk invloed op het vastgestelde herstelplan/oplossing.



Appendix 4 Log poster Strukton Pilot: Case Krol Defect

Game Changer Cards	Case intro		Disrupting personal factors No.2: unclear communication between the teams		Difficult task context No.4 The LWB gets too much phone calls at the same time		Opportunity No.5 The device works again allowing delays to be caught up		Difficult task context No.4 a/b a) LWB gets a call that there are also delayed work at another activity b) The watch keeping of the asset owner demands clarification on the course of events, he remains to call the LWB constantly		Difficult task context No.4 The supervisor arrives at the worksite, what do you do now? Unclear task No.1: ask yourself what the situational awareness of the TRDL is at the moment	
Team	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**
Stretch							x	x			x	x
Build					x				x	x		
Defend	x	x	x	x		x						
Case KROL Defect	**Action 1**		**Action 2**		**Action 3**		**Action 4**		**Action 5**		**Action 6**	
Team	F	M	F	M	F	M	F	M	F	M	F	M
Strategies (S)												
1. Adapt work process		x		S1e; Walk through procedure				x		x		

				H1 again								
2. Add human resources	Call TL to check if there is a delay and what is possible to solve the problem					S2			S2a			x
3. Prioritize					S3b	S3	x	x	S3a	x		x
4. Understand what you see			x		S4a							
5. Seek active reflections				S5a; communicate to LLV about unclear situation						x		x
6. Reallocate resources										x		x
7. Seek different viewpoints												
8. Share learning												
9. Appoint team & info lead					S9a					x		x
10 Create liaison						S10		x		x	x	x

Resources (R)												
1. Information				x				x		x		x
2. People	TL & LLV				R2a; Expert in full knowledge of Strukton business to relieve	R2b; call WB-er				x	x	x

3. Assets		Extra KROL			you		R3a; Crane does it again, work runs	x				
4. Time									R4a	x		
5. Communication		R5a	R5a	x				x		x		x

Approach (A)												
inform TRDL that there may be a delay of activities	F											
LLV calls for WZH status; TL informs LLV; KROL underway after WZH diagnose faulty KROL; inform TRDL about possible extension; inform all TLs		M										
At the moment the situation arises inform the team and take immediate action; help to launch communications			F									
LWB: gathering information; validate, again instruct LLV				M								
appoint 1 extra person to assist and to get everything organized again					F							
Stay put; call WB-er; Only communications via LLV "						M						

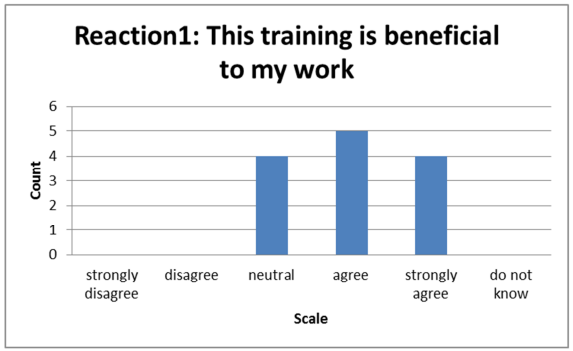
First communication with the TL that the work is late now and that we can engage on time							F					
LWB LLV updated State of Affairs + timekeeping; LWB consults yes / no; LB - TRDL call update								M				
LWB indicates to call TL									F			
LLVers investigate chance on WKZ; arrange continuation; LWB first consults with TRDL; consult WB; inform WB on shift										M		
"Uitvoerder WB on….?....											F	
Once you have time inform and instruct supervisor; Inform TRDL on watchkeeping and the local situation and the status												M

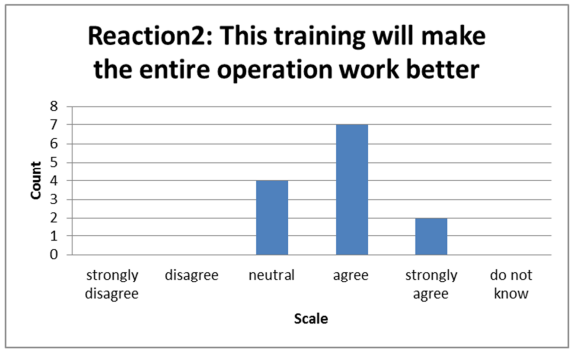
Investment												
1. Workload	3	1	4	1	4	3	3	3	4	5	6	5
2. Safety			1	1	1	4	1	4	1	4	1	4
3. Efficiency	2		3		4	2	3	2	3	4	6	4

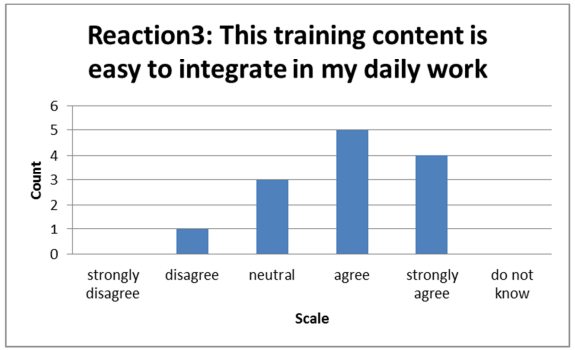
F = Fieldstaff
M = Management
Action = Game round

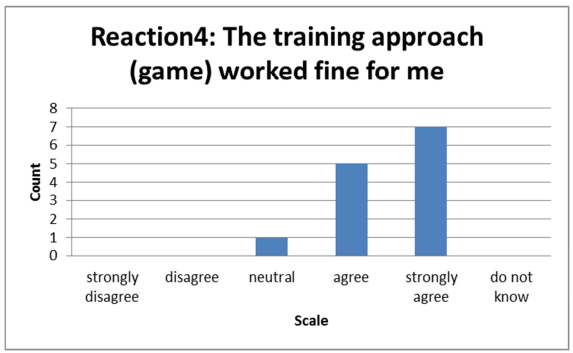
Appendix 5 TORC Questionnaire results NAM

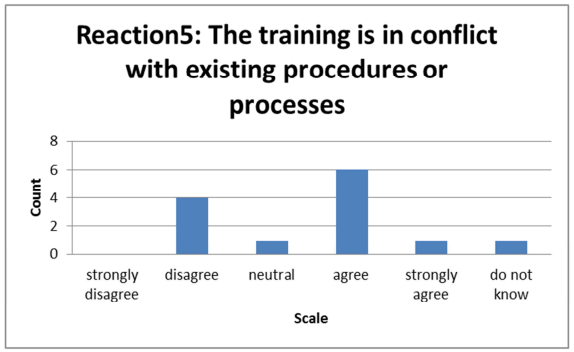
TORC Evaluation level 1: Reaction

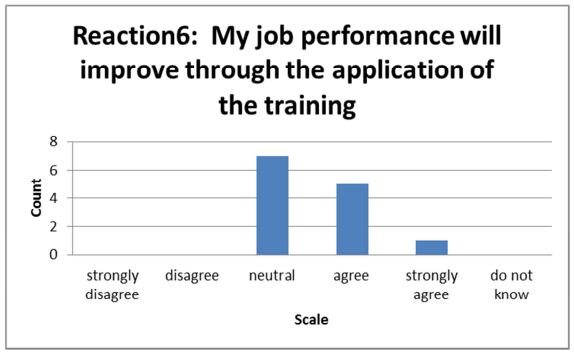


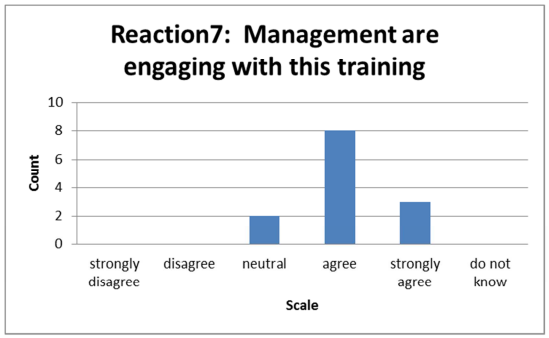




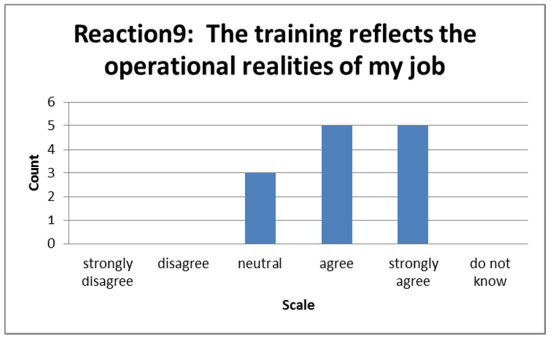






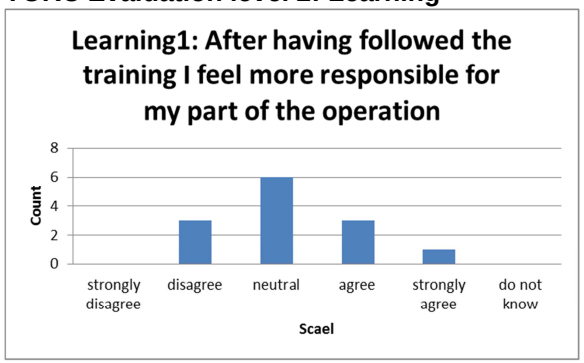

Reaction7: Management are engaging with this training
Count
10
8
6
4
2
0
strongly disagree
disagree
neutral
agree
strongly agree
do not know
Scale

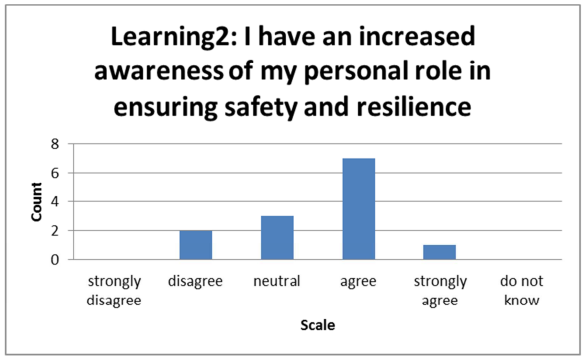

Reaction8: The training made me reflect on my role in ensuring the safety of the operation
Count
5
4
3
2
1
0
strongly disagree
disagree
neutral
agree
strongly agree
do not know
Scale

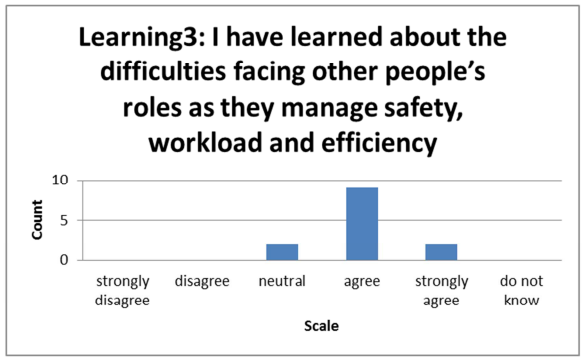

Reaction9: The training reflects the operational realities of my job
Count
6
5
4
3
2
1
0
strongly disagree
disagree
neutral
agree
strongly agree
do not know
Scale

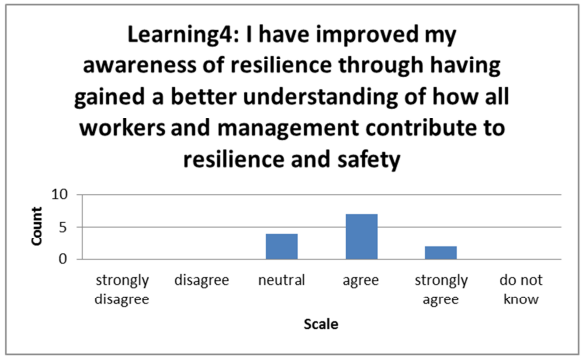

Reaction10: I like that all employees do the same training
Count
7
6
5
4
3
2
1
0
strongly disagree
disagree
neutral
agree
strongly agree
do not know
Scale

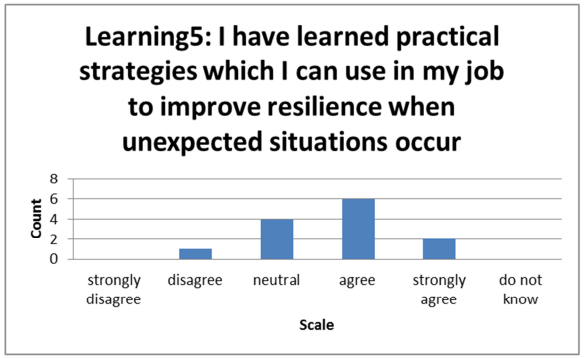
TORC Evaluation level 2: Learning

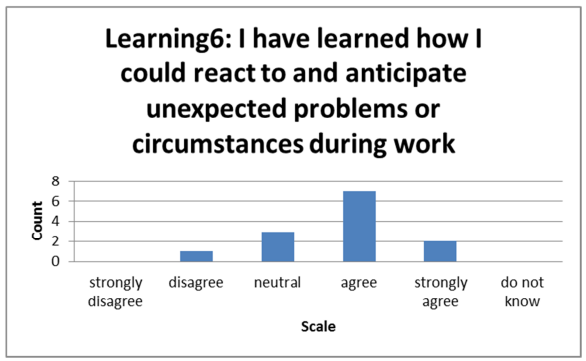


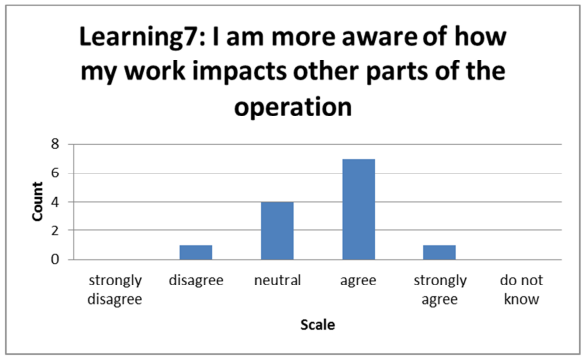


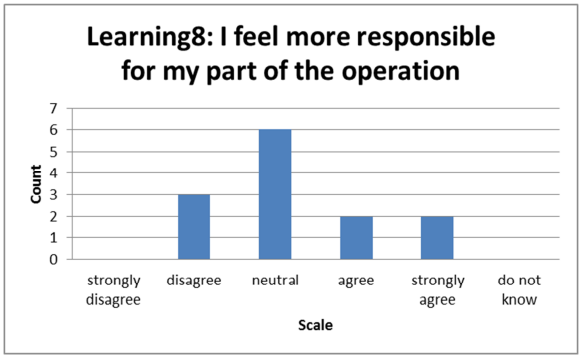


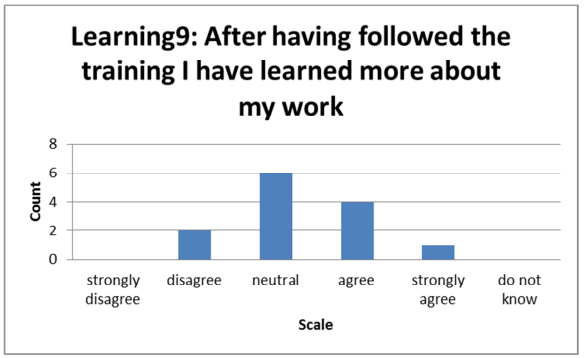


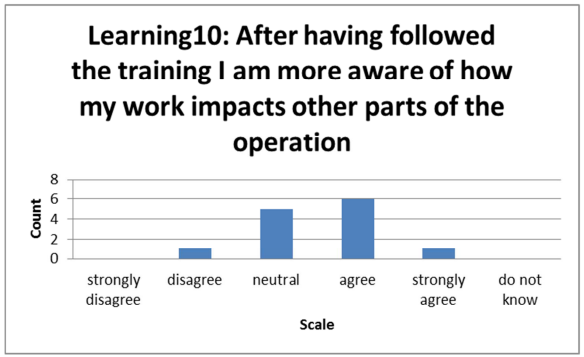


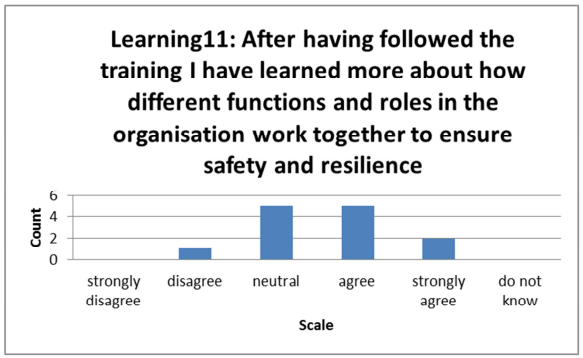


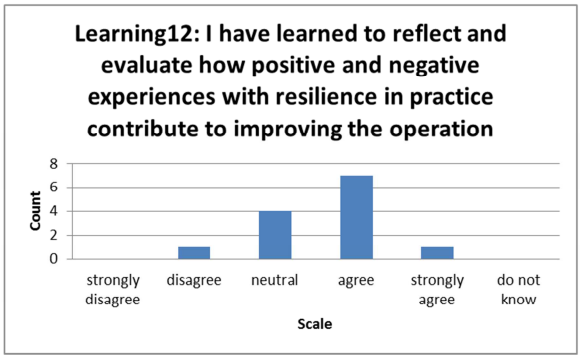

Learning7: I am more aware of how my work impacts other parts of the operation
Count
0
2
4
6
8
strongly disagree
disagree
neutral
agree
strongly agree
do not know
Scale

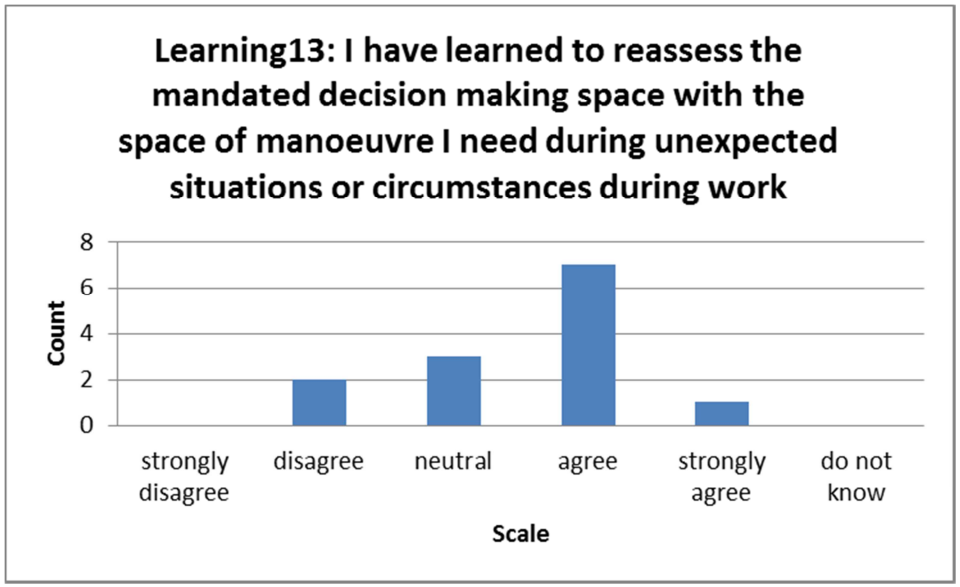

Learning8: I feel more responsible for my part of the operation
Count
0
1
2
3
4
5
6
7
strongly disagree
disagree
neutral
agree
strongly agree
do not know
Scale


Learning9: After having followed the training I have learned more about my work
Count
0
2
4
6
8
strongly disagree
disagree
neutral
agree
strongly agree
do not know
Scale


Learning10: After having followed the training I am more aware of how my work impacts other parts of the operation
Count
0
2
4
6
8
strongly disagree
disagree
neutral
agree
strongly agree
do not know
Scale


Learning11: After having followed the training I have learned more about how different functions and roles in the organisation work together to ensure safety and resilience
Count
0
2
4
6
strongly disagree
disagree
neutral
agree
strongly agree
do not know
Scale


Learning12: I have learned to reflect and evaluate how positive and negative experiences with resilience in practice contribute to improving the operation
Count
0
2
4
6
8
strongly disagree
disagree
neutral
agree
strongly agree
do not know
Scale


Learning13: I have learned to reassess the mandated decision making space with the space of manoeuvre I need during unexpected situations or circumstances during work
Count
8
6
4
2
0
strongly disagree
disagree
neutral
agree
strongly agree
do not know
Scale