Lean European Action-learning Network utilising Industry 4.0

WP 3 - Blended Network Action Learning Methodology

D3.1 Blended Network Action Learning Methodology

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1 Introduction

1.1 LEAN 4.0

LEAN 4.0 is a collaborative initiative between four leading HEI and four industry partners with the objective to integrate Industry 4.0 smart technologies with the proven Lean Manufacturing paradigm. LEAN 4.0 builds on the knowledge gained on the EuroLEAN+ strategic alliance. LEAN 4.0 will educate the operations managers of the future in the best practices in the field of Lean & Industry 4.0. A main output is an open knowledge sharing platform to organize Blended Network Action Learning in practice and digital teaching content for the new and growing "Lean 4.0" community.
LEAN 4.0 will bring HEI closer to the labour market and facilitate the development of future curricula and the skillsets of the future operations managers which will improve the transparency and coherence of qualifications of students. The project's outputs will become the foundation for innovation and knowledge creation in future collaborative improvement and research projects.

1.2 Blended Network Action Learning

1.2.1 Description of WP

Work package (WP) 3 contains the conceptual design of the Blended Network Action Learning (BNAL) methodology. Here, we will specify learning mechanisms and tools to be developed and tested in the project. This work will be led by an applied research partner (SINTEF Manufacturing), as a collaboration between the HEIs and industrial partners to ensure theoretical and practical relevance and benefit. The critical WP3 milestones are:
3.1 BNAL Methodology Guidelines (M7)
3.2 Success factors for facilitating BNAL (M7)
3.3 BNAL draft (M9)

1.2.2 Objective

The aim of WP3 is to conceptualize and develop a methodology for BNAL in the context of Smart Lean Operations. The methodology will be used to solve complex organizational problems in the field of Smart Lean Operations through the development and operation of so-called blended networks (consisting of enterprise and HEI staff, both physically and virtually). The BNAL approach combines concepts from Network Action Learning (NAL) and Blended Learning and will be the basis for performing the pilot projects in WP6. The main goal is to realize an effective approach for addressing complex problems in practice by (i) understanding and framing specific problems, ii) drawing on existing theories to plan action, (iii) taking action that generates inter-and intra-organizational insight to solve the problem, and (iv) reflecting on the results of the action to generate new knowledge in both the practical and academic communities. As such, we define 4 phases of action learning that are fundamental for the development of the BNAL methodology: Constructing action, planning action, taking action and reflection. Based on inputs from WP1 and WP2, the BNAL methodology seeks to address and solve contemporary complex problems in European industry by engaging enterprise- and HEI staff across multiple networks (both physically and virtually) that draw on key and emerging themes in the field of Smart Lean Operations.

1.3 Towards a Methodology for Blended Network Action Learning

1.3.1 Description of deliverable

A framework to for problem identification, analysis, and resolution shall be developed. Guidelines will be provided for how to establish the network (including roles and responsibilities) as well as for planning and taking action. A set of critical success factors for facilitating BNAL in manufacturing will also be identified.

1.3.2 Objective

The objective of the deliverable is to document the development, formalization and validation of the BNAL methodology.

2 Theoretical Background

2.1 Action Learning

Action Learning (AL) has emerged as a radical process for increasing organizational knowledge and capacity for better adapting to change (Coughlan and Coghlan, 2011). It can be considered as a lever for developing, improving and assimilating learning in organizations. Revans (1982) outlines the following assumptions that underpin AL:

- Learning is cradled in the task and formal instruction is not sufficient,
- Solving problems requires insightful questions,
- Learning involves doing, is voluntary, spurred by urgent problems or enticing opportunities and is measured by the results of action.

Revans (1982) formulated his action learning concept around the formula L=P+Q, where L stands for learning, P for programmed knowledge and Q for questioning insight. In his theory of action, Revans (1971) presented his science of praxeology of cyclical systems – alpha, beta and gamma. System alpha focuses on investigating a problem. System beta focuses on solving the problem, and the negotiation cycles required to implement the solution. System gamma focuses on the learning as experienced by participants, and involves self-awareness, reflection and questioning. It is important to emphasize that the three systems (alpha, beta and gamma) are neither linear nor sequential, nor entirely discrete. The three are best understood as a holistic system of interlocking yet overlapping parts which deserve differing emphases at different times (Coughlan and Coghlan, 2011).

At the heart of AL is a distinction between different kinds of issues. Revans distinguishes between puzzles and problems. Puzzles are those difficulties for which a solution exists, and which are amenable to expert advice. Solving puzzles is not amenable to AL. Problems, on the other hand, are difficulties where no single solution can possibly exist. Most complex organizational change projects fall into the category of a problem – where there is no single solution and where there are many opinions as to what the course of action might be. Problems are amenable to AL as, in response, different people can advocate different courses of action in accordance with their own value systems, past experiences and intended outcomes.

2.2 Network Action Learning

Coughlan and Coghlan (2011) suggest that collaborative strategic improvement requires developing a capacity to learn within and across a network, not just as individuals in organizations, but especially within and between organizations. With roots in action learning, Coughlan and Coghlan (2011 p. 33) propose network action learning (NAL) as a useful and usable approach to collaborative strategic improvement:

"Continuous and collaborative improvement are, in essence, processes of action and learning: problems are identified; solutions are created, analysed, selected and implemented; resulting not only in improved operational performance but also in improved capability (through learning)."

They extend the action learning formula and define NAL as L=P+Q+O+IO. This formulation captures the action learning process in the context of both intra- and inter-organizational learning. Here, P refers to the established knowledge of collaborative improvement, Q relates to the questioning process, and O and IO relate to emerging insights in the organizational and inter-organizational contexts. As such, "the action learning by the network is built on exposing programmed knowledge to questioning, combined with organizational- and inter-organizational insights created in action" (p.69). In order to increase competitive advantage, however, the network must be capable of exploiting this learning. As such, participants within and across organizations in the network must engage in appropriate learning interventions in a structured way, consistent with Shani and Docherty (2003) who argue that organizational design is critical to building learning mechanisms that develop and sustain learning capabilities.

3 Methodology – Action Learning Research

Given the action-oriented nature of the study and the focus on learning, we adopt Action Learning Research (ALR) as our approach for defining, developing and deploying the BNAL methodology. ALR is a related but different form of activity to AL (Coghlan and Coughlan, 2010). Coughlan and Coghlan (2011) suggests that the key to understanding this difference is in making the distinction between learning (through action) and actionable knowledge (Argyris, 1993). When engaging in AL, two commitments are relevant: commitment to action and commitment to learning (Marquardt, 2004). There is no expectation, however, that on realization of these commitments, there will be a redeployment of that learning beyond the group, through creation and sharing of the emergent actionable knowledge. As such, ALR requires one further, related commitment – a commitment to adding to existing actionable knowledge. For the action-learning researcher, reflecting on the story of the action (from a theoretical perspective) aims to identify emergent theory so as to contribute to actionable knowledge. In ALR, data can be both collected and generated (created) in action. For a more detailed description of an applied example of action learning research, see Powell and Coughlan (2020).

4 Towards a philosophy for Blended Network Action Learning

Guba and Lincoln (1994) suggest that researchers are typically encouraged to ground their research in a research philosophy consisting of an ontology (reflecting the researcher's understanding of self, own experience, the nature of the relational world and the nature of knowledge and theory), an epistemology (expressing how the researcher seeks to know), a methodology (articulating the set of ideas justifying the approach which the researcher adopts for the process of inquiry), and finally a method (for planning enacting, evaluating and understanding research).

In terms of a philosophy for BNAL, ontology is reflected in Revans (1982 p.83) statement that *"there can be no learning without action, and no action (sober and deliberate) without learning."* The classic formulation (equating learning and knowing) L=P+Q provides an epistemological basis. Most significant for this deliverable is that of methodology, which we base on Revans' (1971) theory of action and science of praxeology of cyclical systems - alpha, beta and gamma:

- *System Alpha*: In BNAL, system alpha frames the complex organizational problem to be solved. It focuses on identifying and analysing a real organizational problem including analysing the external environment, current organizational performance, and management values (what the managers want to achieve).
- *System Beta*: Revans' scientific method presents us with a method for investigating, understanding and solving problems, in action. In BNAL, system beta concerns the deployment of the scientific method and involves exploring the problem-solving process, through multiple cycles of action and reflection. Action learners uses appropriate theoretical perspectives to frame the results of the action and reflection cycles, with a view to identifying emergent actionable knowledge.
- *System Gamma:* The (individual and collective) learning is the focus of system gamma. In BNAL, the active participation of action learners in developing and executing systems alpha and beta has implications for the scope of system gamma. The action learners' involvement in system gamma exposes the process of how their engagement with the problem has challenged their own thought processes, to further inquiry. The interpretation and evaluation of each action learner's own involvement underpins the emergent actionable knowledge, ensuring the quality of the BNAL process.

As such, the remainder of this section is structured as follows: we first present a framework for problem evaluation based on the Find, Face, Frame, Form (4F) framework (Ballé *et al.*, 2017). Secondly, we present a process description for BNAL as well as guidelines for its application. Finally, we present an overview of critical success factors which practitioners and researchers should be aware of when using the BNAL methodology.

4.1 Framework for Problem Evaluation: Find, Face, Frame, Form

Lean thinking executives abandon all preconceptions of traditional management reasoning. For example, *defining* "problems" in the board room, *deciding* what must be done to resolve them, *driving* execution through action plans, and then *dealing* with unexpected consequences (4D) is not an effective means to grow a business. Lean leaders must *find* problems by going to the "Gemba" in order to see the problems faced by workers and customers with their own eyes. This lets them develop a clear understanding of what factors are preventing them from hitting current targets. Armed with first-hand, specific knowledge, lean leaders then *face* the main challenges (the "elephants" in the room / the obvious problem(s) no one wants to discuss) by creating key operational indicators such as improving quality, speeding up delivery, or reducing incidents. Next, they *frame* the challenges and goals in such a way that everyone in the company can understand them and know how they can contribute - lean leaders will propose lean solution types to problem types, such as pulling (instead of pushing) the workflow in order to create value faster for clients or by applying value analysis/value engineering (VA/VE) to conceive and deliver products that clients love, over and over again. Finally, lean leaders support and develop people in order to enable them to *form* their own solutions, so that the sum of all local solutions and ideas forms an effective, collective response to the main challenges.

This forms the basis for the BNAL process – where the organization's leaders must adopt Gemba-leadership to encourage and guide people in their improvement activities, and must begin by accepting the workplace-based, ground-up strategic thinking of finding and facing problems at the Gemba, framing those problems with pre-defined conditions (e.g. just in time, zero defects etc.), and facing them together with the teams themselves (4F).

4.2 BNAL Methodology: Process and Guidelines

Similar to Marquardt (2004), we identify six main components that make up the BNAL framework:

- The problem
- The network
- The questioning and reflective process
- The commitment to taking action
- The commitment to learning
- The facilitator

All six core components must be formalized at the beginning of the BNAL process, but as the process is dynamic and one of discovery, the elements may evolve as the process develops (for example, the problem may be reframed, and new members may be added to the network, etc.).

The problem

The starting point for the BNAL process is the problem (also referred to as the task, the project, the challenge, or the opportunity). Without a problem, there can be no BNAL. The problem should be important and should provide an opportunity for learning (the best BNAL projects provide rich learning opportunities). In the context of the LEAN4.0 project, example problems could be:

- Better leverage technology to create value for customers
- Create an effective inventory management system
- Improve quality output
- Reduce waste in operations
- Increase rate of throughput

The network

The core entity on BNAL is the network (also known as the "set"). The individuals that make up the BNAL team are those who are responsible for framing the problem, constructing action, planning action, taking action and reflecting over action. The ideal number of individuals in the set is suggested as four to eight members, so as to foster a high level of participation and simplify communication channels (Marquardt, 2004).

The questioning and reflective process

The questioning and reflective process is a structured means of guiding strategic improvement within the overall learning cycle. It provides a basis for problem solving while satisfying the learning imperative that is central to the BNAL process. BNAL recognizes that problem solving must begin by first diverging through the use of inquiry, before converging on a solution. Some example questions in the BNAL process include:

- What is the real issue?
- What evidence do we have?
- What do we need to learn?
- Why are we doing this?
- What are the risks?

- Which stakeholders should we engage?
- How do we ensure that the outcomes are achieved?
- Would the problem be solved after we implement this?
- How do we know we have achieved the results?
- What have we learned?

The commitment to action

The members of the BNAL set are committed to implementing change in one or more of the participating organizations. This means that members must be committed to working together to improve the collaborative relationship (be it temporary or long-term), and must commit to solving the problem through participation in action.

The commitment to learning

The learning that occurs in the BNAL process is of greater strategic value to the participating organizations than the immediate tactical value of solving the problem at hand. Learning to learn is a key component of the BNAL process and emerges through combining action with questioning and reflection. It is important to create a safe environment where reflection and learning can occur. Failures in the group must be seen as opportunities to learn rather than events to be hidden or ignored.

The learning facilitator

The learning facilitator, or learning coach, is the catalyst in the BNAL process. The facilitator must enhance the network's ability to learn and take meaningful action. The characteristics of the facilitator should be more in the areas of group facilitation and learning than in the technical expertise required to solve the problem.

Given that these six core components are in place, the BNAL process is guided further by Revans' (1971) theory of action and science of praxeology of cyclical systems - alpha, beta and gamma:

4.2.1 System Alpha – Finding, facing and framing (or re-framing) the problem

System alpha concerns the process description for constructing action in the BNAL methodology. This subtask aims to provide a set of guidelines for constructing a BNAL project to address a problem, including recruitment and initial contact of network participants, selecting the type of participation / mobility (physical or virtual), and arriving at a (broad) definition of learning and improvement needs.

Gemba visit

The BNAL approach begins with a process of reflection and questioning insight at the gemba ("the real place") in order to locate the problem in practice. The gemba visit should be carried out at least by the company representatives (project owner / -sponsor / -manager) and the BNAL facilitator (learning coach), as well as other representatives from HEI and industry, where applicable.

Find and face the problem
Participants in the gemba visit have the potential to discover many problems. Some can be solved with existing solutions and programmed knowledge (these problems are referred to as puzzles and, though amenable to experts, such problems are not amenable to action learning), while others require a great deal of reflection and insightful questions (solving such complex, organizational problems is the primary goal of BNAL). Finding and facing problems effectively often requires the local management team to be challenged by the facilitator (learning coach) to think differently about the observed situation. Facing the main issues of the business by starting with the management team's own misconceptions and taking a helicopter view to find the challenges which limit organizational growth is a critical part of this phase.

Frame the problem
Framing the problem can often mean aligning the entire organization (or indeed network) around compelling learning goals. In the case of LEAN4.0, the facilitator would apply the readiness assessment tool at this stage to help frame the problem and identify the necessary learning and improvement needs (the next step).

Define learning and improvement needs
Though the participants in the BNAL process may not have prior experience of either blended- or network action learning, they may be familiar with the Deming cycle (Deming, 1986): plan-do-check-act (PDCA). This well-established cycle of action and reflection is often referred to as the *learning* cycle.
For companies engaging in BNAL, all improvement actions must be rooted in shared concerns – and a shared understanding of the problem(s) where:

1. Improvement and learning go together, with the share objective of overcoming a problem for which there is no single solution;
2. Simply treating the problem as a puzzle and attempting to solve it with (existing) commercial solutions is not a solution in itself. Rather, if seen as a means and rational for engaging with the problem, the puzzle provides a vehicle for engagement with the real problem.
3. Knowledge gaps present the set with learning needs, where the group must engage in action learning. Simply assigning a reading task or a lecture would be to introduce P only. The plan is to take action, thus questioning insight (Q) from the action must be combined with P in order to solve the problem. This process emphasizes the important role of the learning facilitator – who will help the problem-owner to identify whether the organization has the necessary skills and knowledge to solve the problem alone, or indeed whether external parties should be engaged in the action learning process. This then leads to the identification and construction of the network (see the following section).

Identify and construct network
A first consideration is to decide whether the problem can be satisfactorily addressed using an organizations in-house network. The degree of complexity of the problem and the available resources in the organization determine whether the problem can be solved within the own organization or if other actors should be involved. In the latter case, the learning facilitator should assist the organization in sourcing the relevant expertise externally – acting as a knowledge broker to create ties with external stakeholders. Such ties can be formulated both through physical and virtual (blended) communication. Assuming the problem is significantly complex that it cannot be solved by the organization in isolation, the first step for the learning facilitator is to assess the knowledge, competency and capacity of the existing network of the

organization. This is because existing ties require little effort to build the mutual trust which is beneficial for knowledge transfer and learning interventions in BNAL. Also, as BNAL is focused on problems with a high degree of complexity that often cannot be solved in the organization due to lack of available resources, the organization should reach out to actors beyond the network to start an alliance. By bundling the knowledge and resources of the actors in the network the complex problem can be more easily solved.
Thereafter, the BNAL set is tasked both with action on the initiative as well as with extracting learning from the experience of action towards a solution for the wider problem. As such, the network needs to include an appropriate mix of levels, affiliations, disciplines, functions, responsibilities and experiences. The network also needs to interact on a regular basis throughout the BNAL initiative, where some of this interaction is through participation in scheduled meetings, each with practical, commercial and learning outcomes. A plan for such interaction is the topic of the next section – forming and implementing the solution(s) to the problem.

4.2.2 System Beta – Forming and implementing the solution(s) to the problem

System beta concerns the process description for planning action. This subtask aims to develop a set of guidelines for selecting programmed knowledge from existing theory to help form solutions to the problem defined in the previous step, and also considers how blended learning approaches can be used to provide network participants with fundamental knowledge required in order to address the problem at hand. Important issues to raise here are definition of network roles and responsibilities, assessment of current state, identification and discussion of existing theory, and planning for milestones and performance deadlines.
System beta also concerns the process description for taking action. This subtask will develop a set of guidelines for how the individuals in a network can effectively take action to solve the problem, also with a view to creating new knowledge and learning. Important considerations include identification of emerging issues as well as review of training and facilitation needs.

Define Network Roles and Responsibilities

A core part of BNAL is the network (also known as the "set"). The individuals that make up the network are those who are responsible for solving the problems – through constructing action, planning action, taking action and reflecting over the action. After the problem is identified, the foundation for the network should be laid using the following six steps, for which we rely on the work Sydow *et al.* (2015) to further conceptualize the intra- and inter-organizational networks, namely allocation, regulation and evaluation, as well as the important role of the network administrator.

Allocation: Once the partners for the network are selected, the resources, tasks and responsibilities should be allocated and aligned across the network partners. The partners are tied together in the network and strong cooperation is needed to solve the problem. It is important that this is all formalized.

Regulation: In this step, rules for the collaboration are formalized and implemented. All network partners should live by the rules of the game (though these rules can be both formal and informal). When a new partner enters the network, she should comply with the existing rules in the network. However, the rules of engagement may change over time as the network evolves.

Evaluation: The last step in creating an effective network to solve problems with BNAL is evaluation. The network should be evaluated regularly to see whether it is going in the right direction. The contributions of the individual partners, the performance of the whole network and the relations between the network partners are evaluated. It should be evaluated if actions should be taken to stay on track. On top of that, it is important that every partners' opinion is considered in the evaluation. Organizations weigh up the disadvantages and advantages of being part of the network and this in turn influences the effort they will make. Effort to maintain quality relationships with other partners and effort to take action and share knowledge. Thus, the effectiveness of the network depends on how the partners rate the quality of the network.

Network administrator: A network administrator should also be appointed to facilitate the network – this is a distinctly different role to that of the learning facilitator. The network administrators job is to administer knowledge sharing among partners, while the learning facilitator strives to enhance the network's ability to learn and take meaningful action. With regard to the evaluation, the network administrator evaluates the network from his perspective. Is the way the network facilitator sees the network equal to how the individual partners experience it? If not, it is the job of the network facilitator to find the imbalance and take action. For an effective network in which partners are willing to share their knowledge, resources and learnings, high levels of trust and reciprocity are important. In the evaluation it should be considered if the levels of trust and reciprocity are desirable or that actions should be taken.

Planning and taking action

Having established the roles and responsibilities within the network, the set can begin to plan and take action in order to address the problem at hand. This involves using the scientific method as follows:

1. *Assess Current State*
2. *Agree on Target State*
3. *Plan for Action (Incl. Selection of Programmed Knowledge)*
4. *Take Action (using loops of PDCA)*

Having also found and framed the problem in the previous step, A3 management is a well-known and well-documented scientific problem-solving process that presents leaders with a step-by-step approach to plan and take action, closely modelled on PDCA (Richardson and Richardson, 2017). The term A3 in fact refers to an international standard paper size (297 x 420 mm). Toyota adopted the name A3 drawing on insight that every issue an organization faces can and should be captured on a single sheet of A3 paper. While the basic thinking for an A3 follows a common logic, the precise format and wording are flexible, and most organizations tweak the design to fit their unique requirements (Shook, 2008). A typical A3 template is shown in Figure 1.

A3 management also serves as an important means of communication – such that countermeasures developed during the problem-solving process can be standardized and shared with others (Liker and Hoseus, 2008). Richardson and Richardson (2017) present this form of "standardized storytelling" as a powerful tool to engage and empower leaders as well as front line personnel. They conclude that it is the thinking behind paper, not the A3 paper itself, that is most important.

4.2.3 System Gamma – Reflecting over learning and emergent actionable knowledge

System gamma concerns the process description for reflecting over action and learning, which occurs in parallel to the activities defined in system beta. This subtask aims to establish a set of guidelines for reflecting over the BNAL cycle(s), including how the experiences and new knowledge can be shared within and outside of the network using blended learning. This should also include assessments of the scale of the collaborative improvement, and a plan / review as to how the process of change has been communicated within and outside the network.

With regard to the A3 process, the effect confirmation and follow-up phases are critical for system gamma. Here, the participants in the network (set) must study the effects of the action (preferably at the Gemba) and use insightful questioning to identify important lessons learned. Here questions must be prioritized over statements.

Any emergent learning should be documented (on the A3 or otherwise) and communicated within and across the participating organizations, so as to share and re-apply any emergent actionable knowledge.

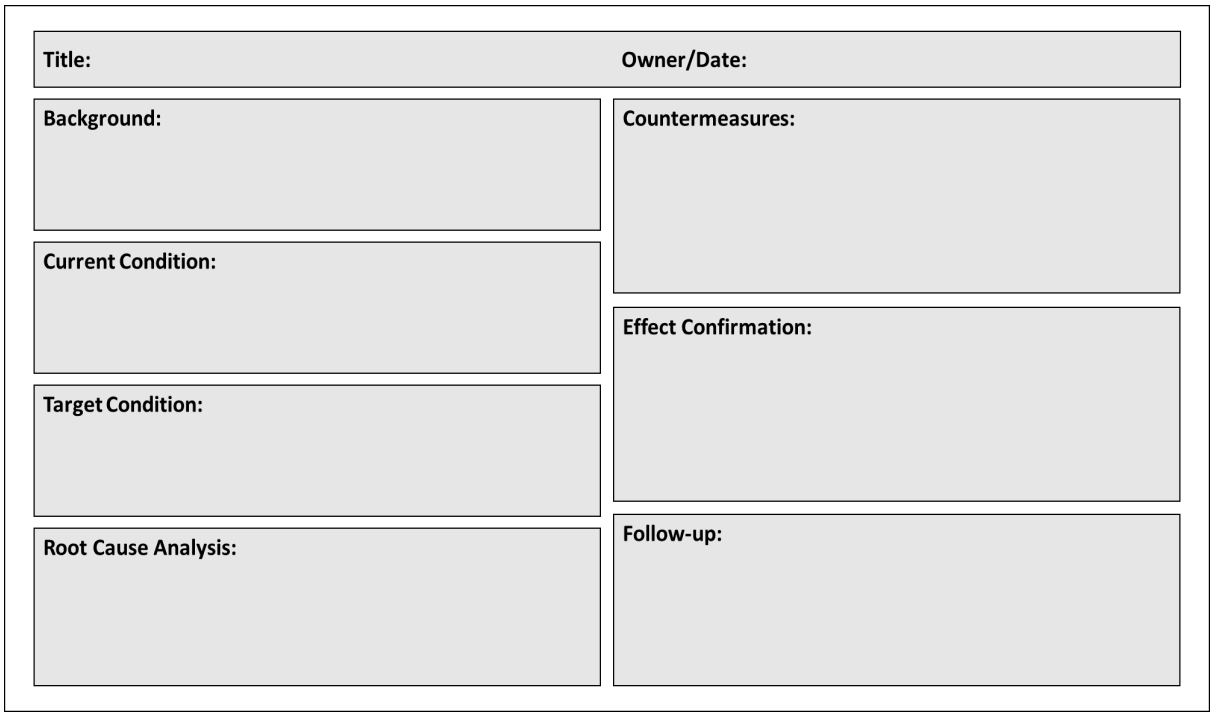

Figure 1: *A3 Template*

4.3 Critical Success Factors for Facilitating BNAL

Freund (1988) defines critical success factors (CSFs) as "those things that must be done if a company is to be successful". In other words, features that are essential for the success of a project (or undertaking). Combining insights from literature (e.g. Ingram *et al.*, 2000) with insights gained from BNAL initiatives in practice, we are able to identify several CSFs for facilitating BNAL, which we can classify as either human, technological or organizational:

1. Human: Human skills, perception, and experience play a central role in successful BNAL facilitation. Human factors include effective communication mechanisms (written, verbal - face-to-face or virtual), education and learning (including training and reflective dialogue) and individual- / team participation.

2. Technological: Technological factors affect BNAL facilitation, especially in terms of the blended part of the BNAL methodology, e.g. user-friendliness and adoption of virtual platforms and systems.
3. Organizational: Organizational factors are often overlooked by companies during the Industry 4.0 implementation (and indeed lean implementations). We suggest that organizational factors such as cross-functional teams, management engagement and involvement, and change management are critical for success.

Considering these important CSFs, the BNAL process should have a useful and useable 'blended' network interface to create a safe learning environment, there should be a clear definition of administrative roles and responsibilities (e.g. project owner, project manager, learning facilitator), there should be a clear charter for project resources (financial, human, technical), and communication channels must be direct and unambiguous. All in all, the facilitators of BNAL projects should create safe learning environments to foster observation and reflection, and ultimately intra- and inter-organizational learning.

5 Conclusion

This deliverable details the BNAL methodology that shall be applied to guide collaborative problem solving and learning processes in the LEAN4.0 pilot projects (WP6) and will be empirically refined and validated through semi-structured interviews and industrial workshops throughout the project. We document a framework for problem evaluation (Find, Face, Frame, Form), a process description for planning and taking action (including guidelines for reflection and learning), and a set of critical success factors for facilitating the BNAL process. The methodology will be applied and tested during the pilot activities in work package (WP) 6.

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