Chapter 5

HUMAN DYNAMICS AND ENABLERS OF EFFECTIVE LEAN TEAM CULTURES AND CLIMATES

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INTRODUCTION

Lean Management is gradually returning to the management (research) agenda, particularly in the growing field of change management. The general focus of prior Lean research has been on operational instruments. Now, however, authors of the available tool-focused studies are calling for a better understanding of the human and behavioral side of effective Lean organizing (Shah & Ward, 2007), including the cultures that enable Lean success (Shook, 2010; Zu, Robbins, & Fredendall, 2010). Indeed, a broad behavioral focus on Lean is needed; through a Lean lens, non-managerial employees are seen as experts in improving daily operational processes and work habits (Bicheno & Holweg, 2009; De Lange-Ros & Boer, 2001; Tucker, Edmondson, & Spear, 2002). Allowing employees to spend time on Continuous Improvement (CI) is now seen as essential for firms to thrive (De Lange-Ros & Boer, 2001; Tucker, Edmondson, & Spear, 2002).

Hackman and Wageman (1995) noted that research focused systematically on behavioral change in Lean settings was very rare; the field was almost entirely based on anecdotal evidence. They called for a new wave of behavioral

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research to fill this void. The purpose of this chapter is to review those empirical studies that have examined Lean team behavior; included in this review are also studies that have addressed the question of how firms can effectively enable Lean employee behavior in their work teams. The chapter offers new insights on how effective Lean work-floor teams work, with an emphasis on their behavioral dynamics and enablers.

This chapter's Lean work-floor team focus is important because: (1) most organizations start their Lean implementation journey on the shop floor (Liker & Morgan, 2006); (2) if the behavioral dynamics at this level of aggregation were to be better known, many of the failures in Lean implementation could be prevented (Ballé, 2005); and (3) workplace teams are foundational for improving the performance of firms. Accordingly, it is the best starting point for successful Lean implementation (Boer & Gertsen, 2003; Edmondson, Dillon, & Roloff, 2007). As the context of each workplace group is unique, this needs to be taken into close consideration. However, there are overarching behavioral patterns to be identified about the people working in Lean teams. The chapter aims to help derive such patterns, with a view to enabling the management of Lean teams.

Our review is structured around three core questions: (1) Which type of human dynamics characterize effective Lean teams? (2) What are the enablers that drive the effectiveness of high performing Lean teams? (3) How can team cultures become Lean team cultures? Given our aim to draw up a multidisciplinary research agenda, we integrate theory and research from disparate literatures, spanning the dynamics of small-group research, leadership, organizational culture and climate, and operations management (OM). Our review includes a comparison of the Lean-specific findings with known factors in team effectiveness (e.g., Bendoly, Croson, Goncalves, & Schultz, 2010; Cohen & Bailey, 1997; Hackman, 1987; Kozlowski & Ilgen, 2006; Marks, Mathieu, & Zaccaro, 2001; Mathieu, Maynard, Rapp, & Gilson, 2008; Salas, Sims, & Burke, 2005; Salas, Stagl, & Burke, 2004). The goal is to offer a fundamental rethink of the behavioral processes underpinning Lean team effectiveness and, in so doing, spur a new stream of practice-relevant Lean team research to advance new theory.

Lean Management and High Performance

The increasing adoption of Lean Management in diverse kinds of organizations reveals a trend towards strategies focused on operational excellence. Over time, different work practices have been associated with Lean Management, such as Continuous Improvement programs such as Kaizen and Total Quality Management (TQM) (Shah & Ward, 2003). Shah and Ward (2007, p. 791) propose the following definition of Lean: "An integrated socio-technical system whose main objective is to eliminate waste by concurrently reducing or

minimizing supplier, customer, and internal variability."[1] In developing a Lean orientation to management, the following five fundamental rules have been noted (Bicheno & Holweg, 2009; Emiliani, 1998; Hines, Found, Griffith, & Harrison, 2008, p. 4; Hines, Holweg, & Rich, 2004; Womack & Jones, 2003):

1. Specify what does and does not create value from the customer's perspective, rather than from that of the individual firm or specific functions, departments, or teams.
2. Identify all the steps necessary to produce the product/service across the whole value stream, in order to highlight non-value-adding waste, such as waiting time.
3. Ensure that those actions that create value flow without interruption, detours, backflows, waiting, or scrap.
4. Only make what is requested (i.e. "pulled") by the customer.
5. Strive for perfection by continually removing "waste" at work as it is uncovered.

Whereas the first four Lean principles may seem achievable merely through analytical methods, in practice they assume that everyone in a given work setting is actively engaged in Lean, and oriented toward continuous, operational improvement. Furthermore, the fifth principle requires employees and managers to continuously monitor for non-value adding routines in order to improve work practices. Lean Management requires the collective establishment of an attitude of "continuous improvement" as well as matching behaviors (Busk Kofoed, Gertsen, & Jørgensen, 2002; Hines *et al.*, 2004). Continuous improvement of work processes in order to increase customer value is the ultimate purpose of Lean production practices. Despite the fact that the behaviors of the key actors involved in Lean production are the key to its success, they have received much less attention than the Lean tools and techniques with which they are supposed to work.

The present review focuses only on work teams that regularly meet face-to-face (daily or weekly), as opposed to virtual teams that operate in a more dispersed fashion (Maznevski & Chudoba, 2000). Since the empirical literature on work teams that have adopted Lean principles is not abundant, our review is quite inclusive. We incorporate a wide range of teams, spanning different skill levels and levels of task complexity (De Dreu & Weingart, 2003). In so doing, we shed light on both the non-local enablers and human dynamics involved in workgroups that have embraced Lean.

Scholars normally associate Lean with high team performance (Shah & Ward, 2003). Team performance is a term often used for the productive output

[1] Although Shah and Ward defined Lean from a conceptual and operational angle, their definition negates the idea that firms may add value by satisfying the increasingly varied customer's wishes (see, e.g., Hines, Holweg, & Rich, 2004).

of a team, irrespective of how the team achieves its performance levels from a behavioral angle (Edmondson, Dillon, Roloff, 2007; Salas *et al.*, 2005). In research on small group effectiveness the term "team effectiveness" is commonly identified and used as the ultimate outcome variable (see, e.g., Cohen & Bailey, 1997; Hackman, 1987; Kozlowski & Ilgen, 2006; Marks *et al.*, 2001; Salas *et al.*, 2005; Salas, Stagl, & Burke, 2004). In this body of work, team effectiveness tends to be operationalized to include not only team performance, but also how the team interacted to achieve its outcomes (Salas, Sims, & Burke, 2005, p. 557). In the context of the so called Input-Mediator-Output-Input (IMOI) model (Ilgen, Hollenbeck, Johnson, & Jundt, 2005), various researchers have noted that team functioning is an ongoing, iterative human phenomenon (Day, Gronn, & Salas, 2004; Ilgen *et al.*, 2005; Kozlowski & Ilgen, 2006; Mathieu *et al.*, 2008; Uitdewilligen, Waller, & Zijlstra, 2010). Consequently, it can be challenging to make a strict division between a team's input enablers and the mediating human dynamic processes. This is certainly the case within Lean workplace teams that are explicitly charged with continuously improving their own "rules of the game," including for instance their work standards, team structure, communication norms, associated practices and routines. For the purpose of this review we consider as mediating type factors those that may also explain the variance in team performance (Ilgen *et al.*, 2005).

Searching for Research on Lean Teams

We conducted a thorough systematic search using the Web of Science and Scopus. In both engines we explored combinations of the following search terms: Lean, as well as the theoretically closely related terms Continuous Improvement, TQM, and Kaizen, combined with Culture, Climate, or Behavior (for example: Lean climate, Lean culture, and Lean behavior). Criteria for publication selection in the initial sample were: use of the search terms in the title, abstract or keywords, and a focus on organizational settings. This sustained query allowed us to assemble an initial sample of 709 Lean writings varying across organizational contexts, levels of analysis, and quality. We then narrowed down this sample based on specific inclusion and exclusion criteria and checked the back references as well as the forward citations of the final sample (in doing so we followed the review advise given by Wolfswinkel, Furtmueller, & Wilderom, in press). In the end, we found only 13 high quality empirical papers published between 1995 and 2010. Nine of these dealt with manufacturing firms and four studies were carried out in other types of firms (see Table 5.1 for a summary of the selected papers).

It is noteworthy that the 13 selected studies employed a variety of methods, ranging from surveys and interviews, to participant-observation, action research, and a videotaped optimization task within the field. One study reported on a longitudinal team survey that tracked the changes in team climate during two Lean implementation phases (see, Mullarkey, Jackson, & Parker,

Table 5.1 The set of 13 analyzed empirical Lean team studies

Author (Year)	Dependent Variables	Sample Size and Type	Methods Employed	Key Findings
1. Bunderson and Boumgarden (2010)	Team learning	40 teams, incl. 228 production team members, 81 supervisors and engineering managers	Survey	Psychological safety does not relate to team learning. Team structure positively affects team learning.
2. Ooi, Arumugam, Teh and Chong (2008)	Production workers' job satisfaction	173 production workers	Survey	Organizational culture and teamwork positively affect production workers' job satisfaction.
3. Kauffeld (2006)	Team competence	459 workers in 44 self-directed production groups and 39 traditional production groups	Videotaped optimization group task and a survey to assess team design	Self-directed work teams are more competent when solving an optimization task than traditional work groups.
4. Bateman and Rich (2003)	Sustainability of process improvement activities	40 change agents, team leaders and operators	Interviews	Progress in process improvement initiatives relies on a culture change.
5. Rothenberg (2003)	Employee participation in environmental management	55 employees	Interviews, 4-week field observation and a document study	Role of specialist staff is critical for environmental improvements; they support worker participation. A culture of collaboration and trust enables this specialists' behavior.
6. Bessant, Caffyn, and Gallagher (2001)	Development of continuous improvement	Various teams in 6 firms	Action research on particular CI problem issues	Developing CI is an evolutionary process. Nine key routines are identified that need to be developed in a firm for this purpose.
7. Godard (2001)	Work experience (belongingness, task involvement, empowerment, workload, stressfulness), and Outcomes (fatigue, self-esteem, job satisfaction, commitment, motivation, citizenship behavior)	508 randomly selected Canadian workers	Telephone survey	Traditional, supervised groups have more positive worker outcomes than "high-performance" models such as Lean, team, and post-Lean forms of organization.

(*continued*)

Table 5.1 The set of 13 analyzed empirical Lean team studies (*Continued*)

Author (Year)	Dependent Variables	Sample Size and Type	Methods Employed	Key Findings
8. Jackson and Mullarkey (2000)	Psychological wellbeing	556 production workers	Survey	Work demands significantly affect worker's psychological wellbeing. Social support significantly affects workers' job satisfaction.
9. Waldman, Lituchy, Gopalakrishnan Laframboise, Galperin and Kaltsounakis (1998)	Quality improvement; culture shift	26 senior managers, middle managers and lower level employees	Interviews	Continuing top management vision and commitment leads to a quality improvement culture. Wavering organizational commitment leads to cynicism about culture change.
10. Daniels and Burns (1997)	Goal congruence	2 production managers, 6 team leaders	Interviews, survey and participant observation	Goal congruence between top management and "cell" leaders is high. Cell leaders focus more on the short term.
11. Zeitz, Johannesson and Ritchie (1997)	Total Quality Management practices and culture	288 production workers, 123 service workers, 475 employed Master students	Survey	All TQM practices and culture-related aspects improve significantly in more advanced TQM program levels, except for "social cohesion" and "trust:" that remained at medium levels.
12. Delbridge (1995)	Development of workplace relations between management and workers	Production workers and team leaders	Participant observation	Team leaders effectively speed-up the change process. Peer pressure in JIT teams undermines the collective goals and raise intra-team conflicts.
13. Mullarkey, Jackson and Parker (1995)	Individual autonomy, Team autonomy, Job demands, Group climate, Psychological wellbeing	65 production workers	Longitudinal survey	The first implementation phase has a positive effect on individual autonomy, the second phase positively affects group climate.

1995). We thus feel confident that our relatively small sample is methodologically diverse, providing various lenses through which to view the human side of Lean teams. An initial analysis of the 13 studies found that the research contexts varied enormously. Some of the research was carried out on high-performing teams, others on low-performing Lean teams. Some of the studies were of mature Lean teams, while others reported on teams that were just starting to become a Lean team. Despite the fact that some of the 13 studies lack conceptual, operational, or situational precision, we were able to distinguish two basic categories of Lean team factors that were treated by these 13 studies: human dynamics and enablers.

The *human dynamics* category includes intra-team or interaction behavior, including affective and cognitive states between team-members and the team leader (DeChurch & Mesmer-Magnus, 2010; Ilgen *et al.*, 2005). Such internal team interactions are mostly invisible to those working outside the team. We define these "'intra-team dynamics" as follows: all mediating or moderating factors that transform external team inputs into collective team outcomes.

The *enablers* category refers to the resources (i.e., behavior and practices, etc.) that are needed in order to help create a high-performing Lean work team. Even though team enablers tend to be determined outside the team, individual members and other intra-team factors have an impact on them as well. In other words, while the team dynamics and their enablers are to some extent mutually dependent on each other, in what ways they are linked is thus far largely unknown. Thus, enablers are assumed to affect (emerging) Lean team's human dynamics, including the degree to which a team's (improvement) effort is effective. Kozlowski and Ilgen (2006) have named enablers as input conditions (such as a firm's new strategy) or design factors (e.g., job design and HRM systems). Given the inherently dynamic character of these contextual team factors, evolving over the course of getting to Lean, we prefer the term enablers over the static term condition. We define these factors here as enablers that must be organized by higher management and other actors, during a change process, for a team to start or sustain effective Lean behavior.

Given the small set of empirical Lean team studies (K = 13), we supplemented our analyses of Lean team effectiveness with relevant results of the much more established team-effectiveness literature. Given that Lean workplace teams strive for perfection (see, e.g., Womack & Jones, 2003), we assumed that Lean teams develop in ways that are similar to otherwise highly-effective teams. We turn now to presenting the studied factors: first the nine human dynamics operating within a Lean team, and then the four enabling ones.

HUMAN DYNAMICS WITHIN LEAN TEAMS

In this section we focus on the human factors explored in the selected sample of empirical studies. For each factor we summarize the studies' findings, and

link these insights to what we know more generally from the team-effectiveness literature.

Psychological Safety

This motivational team factor was studied in five of the 13 selected papers. Compared to similar non-Lean plants Rothenberg (2003) found more trust at New United Motor Manufacturing, Inc. (NUMMI), including a more *collaborative culture*; Rothenberg stressed that without trust no employee will contribute towards the improvement of work practices. Bunderson and Boumgarden (2010) surveyed a sample of 40 teams and detected a significant link between psychological safety and learning behavior; this link was mediated by information sharing as well as conflict frequency.

In contrast, Zeitz, Johannesson, and Ritchie (1997) found no significant increase in "trust" during the course of TQM implementation. In their longitudinal study, also Mullarkey, Jackson, and Parker (1995) saw no significant increase in "trust in co-workers." Hence, interpersonal trust levels do not seem to appear to increase over time in Lean teams. One interpretation could be that an already fairly high trust level may be needed before Lean practices get underway. Indeed, Jackson and Mullarkey (2000) found that Lean teams have a significantly higher level of co-worker trust than similar non-Lean teams; clearly, the trust levels of Lean teams might or might not improve over time, depending on both its base level and other team dynamics.

From Salas, Sims, and Burke's (2005) critical review of numerous studies of small-group effectiveness predictors we learn that: (1) the more the mutual trust within teams, the more likely team members will accept mutual monitoring of team member's performance; and (2) mutual trust supports information sharing among team members. Moreover, in psychologically safe Lean teams, members feel free to discuss improvement suggestions and learn from mistakes in order to remove waste and innovate in work practices (Baer & Frese, 2003; Edmondson, 1999, 2011). This happens even if the members lack confidence about their own tacit knowledge about their work (Siemsen, Roth, Balasubramanian, & Anand, 2009). Baer and Frese (2003) found that organizations with a high climate for psychological safety had a significantly higher return on assets than firms with a low level. We thus conclude that high Lean team performance is a function of team members feeling psychologically safe to discuss errors or ideas for improvement. At the same time, when members of Lean teams feel charged not only to maintain but also to co-create a high level of psychological safety this may lead to high Lean team performance.

Team Cohesion

The notion of team cohesion was included in five of the 13 Lean-team papers. Mullarkey, Jackson, and Parker (1995) found that clustering teams in

U-shaped assembly areas led to significantly more team cohesion. Jackson and Mullarkey (2000) questioned 242 Lean team members and found that a greater degree of task interdependence led to more frequent social contact within multiple Lean teams. It also led to frequent quarrels and less cooperation among team members, and group cohesiveness was shown to be significantly lowered. Similarly, using a video-analysis method, Kauffeld (2006) reported significantly more negative criticism in 44 teams that implemented a self-directed mode of working. Delbridge (1995) found that JIT-related work pressure and subsequent intra-team self-policing led to "considerable tension" and more arguments among workers, especially in the form of blaming other sub-groups on the line. Zeitz, Johannesson, and Ritchie (1997) reported no enhanced social cohesion after TQM program implementation.

Based on the Lean team findings to date it is tenable that before effective Lean team production can take place social-cohesion levels must surpass a certain threshold. Nevertheless, the reported findings to date also suggest that Lean team cohesiveness may be lower in the short term (due to a Lean team's initial struggle to change things in its non-value adding tasks), but that it may improve during more advanced stages of Lean implementation (Mullarkey, Jackson, & Parker, 1995). It is quite remarkable that none of the Lean team cohesion studies have looked at the link between team cohesion and employees' perceived effectiveness of the change management approach taken. A poor approach to change may have two contradictory effects on team cohesion. On one hand team members might engage in more frequent discussions, leading to opportunities for conflict and lower cohesiveness. On the other hand, Lean team members can develop greater team cohesion due to bonding against a "common enemy" (e.g., the managers or advisors of the change program).

Team-effectiveness studies tend to examine team cohesion as a positive motivational variable (Chin, Salisbury, Pearson, & Stollak, 1999; DeChurch & Mesmer-Magnus, 2010; Kozlowski & Ilgen, 2006; Mathieu *et al.*, 2008). Effective teams are known to have greater interpersonal cohesion and pride, as well as a greater sense of working on a collective task. Yet, social psychologists have pointed to the risk involved in highly cohesive teams: that is, groupthink, which often leads to operational errors (e.g., Bendoly *et al.*, 2010). Hence, when members of a Lean team conform to a certain mindset with fixed and narrow assumptions, this might hold back any further performance improvement or learning, as shown within a sports team by Rovio, Eskola, Kozub, Duda, and Lintunen (2009). In highly cohesive teams, a sense of criticality may be lacking in the way they handle their work and their co-workers. To be highly cohesive and tackle groupthink at the same time is likely to require a medium level of psychological safety in order to air feelings. Such safety needs to be promoted by the team leader (Moorhead, Neck, & West, 1998). Accordingly, we propose that members of high-performing Lean teams feel a moderate amount of team cohesiveness. In the team-effectiveness review of Mathieu *et al.* (2008) it is noted that progress towards goal accomplishment may function as

"*dynamic inputs*" (p. 462) to emergent states, such as team cohesion. In other words, a Lean team may, under certain circumstances experience an elevated level of team cohesion, but that state might only be temporary.

Conflict Management

Five of the 13 papers addressed conflicts within Lean teams. Zeitz, Johannesson, and Ritchie (1997) showed that good communication, including solid conflict resolution, was significantly enhanced during TQM implementation. Bunderson and Boumgarden (2010) showed that frequent intra-team episodes of conflict, especially territorial ones, are not likely to result in effective outcomes (see also Delbridge, 1995). It was shown that if a team is well-structured, members are more likely to learn from work experiences, including conflict. In terms of effectively solving problems at work, Kauffeld (2006) found that compared to traditional teams, self-directed teams showed more "professional competence" in linking problems to solutions; video-analyses of the teams found that the self-directed teams were able to rephrase problems much better than their traditional counterparts. Bessant, Caffyn, and Gallagher (2001) had already noted that more mature Lean teams readily take the initiative to both identify and solve issues; they make addressing problems part of their normal working culture.

These findings on conflict in Lean teams are consistent with what is known already about conflict resolution in general (cf. Ilgen *et al.*, 2005; Kozlowski & Ilgen, 2006; Marks, Mathieu, and Zaccaro, 2001); the team-effectiveness literature claims that team conflict is generally ineffective, yet the outcomes depend on the specific ways of handling a dispute (Tekleab, Quigley, & Tesluk, 2009). If team members are used to getting and giving feedback, effective conflict management occurs (Ilgen *et al.*, 2005). Indeed, Kozlowski and Ilgen (2006) documented how constructive feedback led to learning behavior and goal accomplishment. Feedback sheds light on discrepancies (such as poor product or service quality) and reveals, for those who are willing to confront and solve problems, possibilities for improvement. Such feedback must not take the form of blaming (Delbridge, 1995), which prevents constructive conversation and jeopardizes team cohesion and psychological safety (Bendoly *et al.*, 2010). Hence when conflict occurs in Lean teams, providing it is dealt with constructively, improvement or learning is likely to take place, including exploration of new solutions. Equally, the negative impact of a team conflict depends on whether the conflict's nature is task- or process-related (cognitive), or relational (affective) (Jehn, 1997; Tekleab, Quigley, and Tesluk, 2009; Zaccaro, Rittman, & Marks, 2001). Delbridge's (1995) study reported an affective, relational type conflict: blaming others for failure. Indeed, high levels of process or relational conflict have shown to be detrimental; whereas a moderate amount of process conflict may lead to higher efficiency and task conflict is likely to improve the quality of team decision making (Jehn, 1997).

The above observations resonate with recent work in the emerging area of Positive Organizational Behavior. After a conflict has emerged, forgiveness (Quick, Cooper, Gibbs, Little, & Nelson, 2010), self-reflection (Bendoly *et al.*, 2010) and motivation to learn from significant others can be transformative (Quick *et al.*, 2010). In other words, if team conflicts are dealt with in constructive ways, team learning may occur. Edmondson (1999) suggested that continuous team learning behavior is centered on potentially conflicting activities such as seeking team feedback, discussing errors and seeking feedback from customers (Bartezzaghi, Corso, & Verganti, 1997; De Lange-Ros, 1999). Van Dyck, Frese, Baer, and Sonnentag (2005) found evidence that openly discussing errors and learning from them enhances financial performance. Clearly, effective conflict resolution within Lean teams is needed so that effective closure, including team learning, is secured. Despite this high convergence of findings regarding team conflict, there are still ample new-research possibilities, for example in terms of the character of incidents that occur in Lean teams and their differential effects on team performance. It is likely that effectively resolving task conflict leads to higher Lean team performance while only moderate amounts of process conflicts may lead to higher Lean team performance. Relational conflict, on the other hand, may dampen Lean team performance. Moreover, the more constructive feedback members of a Lean team give and get, the higher their team's performance. Coaching members of embarking Lean teams on how to identify and handle conflict in a constructive way may aid them to do well, in addition to enhancing their feedback and constructive discussion skills.

Team Member Support

The idea of team member support was investigated in five of the 13 Lean team studies, although with conflicting results. Three studies found an increase of team member support due to Lean implementation. For example, Mullarkey, Jackson, and Parker (1995) reported a significant increase of such support after their Lean implementation. Investigating a range of organizational citizenship behaviors (OCBs, including helping others with work-related problems or team member support) Godard (2001) established a significant link to various Lean practices (such as quality management, team-based work systems, regular information sharing and quality circles). Rothenberg's (2003) analysis of the shop floor at NUMMI, characterized as *egalitarian* and *collaborative*, found an increased access to member support. Nevertheless, two studies reported otherwise: Jackson and Mullarkey (2000) found that in both Lean and non-Lean teams, team member support was linked to low job satisfaction, while Delbridge (1995) observed that workers spotted and helped to fix their colleague's mistakes in order not to be held accountable by their leader for others' faults. However, in both studies, the support provided by the team leaders and their higher-level managers was found to be inadequate; they might have

role-modeled the low level of intra-team member support they found. In other words, these studies provide preliminary evidence in favor of increased team member support. In sum, in Lean implementation settings, high team leader support is likely to lead to higher levels of Lean team member support, which in turn predicts high Lean team performance.

Of interest here is the parallel idea of back-up behavior (see, e.g., Marks, Mathieu, & Zaccaro, 2001; Salas, Sims, & Burke, 2005), defined as task-focused helping behavior between team members (Seers, 1989). In order for this back-up behavior to take place, team members must engage in mutual performance monitoring (Salas, Sims, & Burke, 2005), so that they know where and when back-up is needed, and can take the appropriate action if it looks as if the team may not reach its targets. Yet, back-up behavior has been shown to be counterproductive, especially in Lean teams with an evenly distributed workload among its team members: team members' helping behavior dampens the time they have available for their own tasks, resulting in inefficiency (Barnes *et al.*, 2008). Hence, when Lean team members adopt much back-up behavior they may only be fixing symptoms, instead of solving the underlying problems (cf. Bicheno & Holweg, 2009; Imai, 1997; Shingo, 2007). In other words, a lot of within-team support may be a sign that the team is not doing well; it may detract from their potential performance (see, Barnes *et al.*, 2008) and may prevent them from learning about the root-causes of the issues that come up. This lack of learning and associated lower performance goes against the grain of Lean's continuous improvement ideology. The upshot of this complex pattern of findings is that it is unlikely that back-up behavior occurs much in mature Lean teams, due to the fact that they already enjoy fairly optimized work processes. Hence: (1) High-performing Lean teams experience a moderate level of team member support; (2) In high-performing Lean teams back-up behavior occurs, but only in unforeseeable or incidental circumstances; and (3) A high level of back-up behavior within Lean teams is associated with a lowering of team performance.

Performance Monitoring

Three Lean-team case studies addressed task-focused "performance monitoring." Rothenberg's (2003) analysis of NUMMI noted that Lean team workers are particularly data driven, controlling their work based on reliable, real-time performance indicators: "Lean plants tended to have a greater number of water and energy meters in critical locations, were more likely to chart and post water and energy data on the departmental level, and posted this data more often" (Rothenberg, 2003, p. 1795). Indeed, the workers at NUMMI were trained to read charts and graphs for the effective analysis of production data. Bessant, Caffyn, and Gallagher (2001) reported that employees in daily team meetings discussed work issues, progress, and targets, and engaged in various other forms of progress monitoring and knowledge capturing. As a

result of this reflection on performance data, team members frequently recognized that change was needed. Delbridge (1995) observed a case where "'individual performance targets" for each worker and team leader were employed. An intra-team quality control function and high managerial pressure spurred the teams to develop new norms. Peers would put pressure on their low-performing members to improve their quality. Although the three cases all suggest that Lean teams must adopt performance monitoring for purposes of performance improvement, its relation to Lean team performance is not yet firmly established.

In the team literature we find compelling evidence for monitoring progress toward goals (Marks, Mathieu, & Zaccaro, 2001): Based on effective continuous performance feedback, an effective team is likely to feel the need to continuously improve their work practices. A team's need for on-going adaptation, based on iterative performance cycles, brings into play another generic team factor: adaptability (Kozlowski & Ilgen, 2006; Salas, Sims, & Burke, 2005). Members of effective workplace teams are expected to learn from each other and effectively deal with change (Uitdewilligen, Waller, & Zijlstra, 2010). Although Lean tends to evolve into carefully prescribed, standardized work processes, unanticipated events occur regularly. Dealing with such deviations may lead to adaptation to a new situation. A typical Lean example is the use of an Andon-cord for highlighting an error that requires immediate repair (Stewart & Raman, 2007). During and after these moments a team is supposed to learn from the event and then fix it, possibly by adjusting a part of the standard work routine. On a daily basis a Lean team is supposed to discuss these "errors" and their correction, both temporary and more permanent type of actions. Hence we propose that: High levels of performance monitoring leads to high levels of Lean team learning and as a result to high Lean team performance. In other words, members of highly performing Lean teams seem to adapt their behavior quite readily after self-interpreting a regular stream of performance data. Members of effective Lean teams see regular discussions of their team's performance level as chances to further optimize their added value, and thus their on-going team performance. How exactly the performance dashboards come about in operational teams might very well make a difference here; Wouters and Wilderom (2008) showed that a high degree of employee involvement in designing their own team's performance measurement tools enhances both team trust and performance levels.

Information Sharing

In four of our corpus of 13 studies information sharing was suggested to be a key characteristic of Lean workplace teams. Bunderson and Boumgarden (2010) showed that more structured teams tended to share more information, which in turn affected a team's learning orientation. At NUMMI, hourly workers were found to participate in suggestion programs and problem-solving

circles (Rothenberg, 2003). Moreover, Bessant, Caffyn, and Gallagher (2001) documented a problem-solving process and the use of appointed contact persons (for each type of occurring problem) within one of their six case companies. Delbridge (1995) described Lean-typical daily pre-production team briefings where tacit information and knowledge exchange took place. In these start-up meetings the less effective workers did not actively share information; they were simply passive attendants. It therefore seems that Lean teams are significantly more effective when all team members engage in sharing improvement oriented work-related information.

Previous research on highly effective teams has also shown that members share a relatively large amount of information (see, e.g., Kozlowski & Ilgen, 2006; Salas, Sims, & Burke, 2005). In each firm there is a vast store of tacit and local knowledge, which seems particularly well exploited in a Lean mode. It is worth studying how extensively Lean team members share tacit kinds of job- and/or team-level information (including own ideas on how new or persisting work interruptions occur and might be solved). We would expect that in Lean teams such intra-team sharing of work-related information (that in non-Lean teams remain tacit) may have a performance enhancing effect. Moreover, effective Lean teams will typically have developed one or more simple structures and/or daily routines for the purpose of optimal information sharing, so that all team members are able to continuously work to full capacity. Hence, we propose that when Lean team members regularly share various types of work-related information (e.g., in pre-work meetings), it will lead to higher Lean team performance.

Innovating

Three of our studies addressed innovating as a behavioral dynamic in Lean teams. Based on a survey of workers, Zeitz, Johannesson, and Ritchie (1997) claimed that "innovation" improved significantly over the course of a TQM program. Bessant, Caffyn, and Gallagher (2001) reported on a case in a mature Lean work setting where both individuals and teams take time during their working day to experiment and develop new ideas, leading to entirely new-to-the-world procedures and practices. In addition, Kauffeld's (2006) team task video analyses showed that compared to traditional teams, self-managed team members were more self-competent, in the sense they were more improvement- and innovation-oriented while solving the task at hand. Thus, when a team is effectively engaging in Lean, team members show a high level of change orientation in terms of both continuously improving and innovating work practices.

Not long ago Toyota's president Watanabe stated that it was time to expand incremental CI (i.e., Kaizen) and to make more radical improvements (i.e., Kakushin): "While trying to come up with incremental improvements, many people come up with revolutionary ideas. . . . I am only trying to get people to make the leap from incremental improvement to radical improvement

wherever possible" (Stewart & Raman, 2007, p. 82). While it took Toyota several decades to ignite radical improvement, revolutionary ideas may also spring from incremental improvements, and they may need to be taken more seriously, given the more competitive landscapes of most older businesses (such as those in the automotive industry) today. Calantone, Cavusgil, and Zhao (2002) show that a learning orientation (for instance knowledge sharing and being open to criticism) increases firm innovativeness. Moreover, it was found that Lean has a direct influence on employee's innovation orientation (Santos-Vijande & Álvarez-González, 2007). In other words, there is initial evidence that the continuous improvement efforts of a high-performing Lean team lead to a mindset with a high degree of innovativeness.

Organizational Goal Commitment

Two of the 13 studies dealt with organizational goal commitment within Lean teams. Bessant, Caffyn, and Gallagher (2001) noted, in three of their six cases, that in advanced Lean firms, employees show a high level of awareness of both company goals and strategic performance measures. In contrast, Delbridge (1995) observed production workers in an ineffective Lean team distancing themselves from the goals of the organizations. They ignored discussions, company-uniform prescriptions, and refused to participate in improvement initiatives, openly showing a lack of organizational commitment. Hence, Lean team studies provide only limited support for the idea that goal commitment is a behavioral dynamic of Lean significance.

Goal-setting theory (Locke & Latham, 2002) may help to further analyze the importance of organizational goal commitment to Lean teams. Lean as an organizational goal tends to be set by higher-level managers (Kanji, 2008). According to goal-setting theory, employees must first understand the importance of becoming Lean and believe they are able to achieve the goal in question (high team- and self-efficacy). This will make them more committed to the goal, which in turn may lead to significantly higher performance (Locke & Latham, 2002). In addition, workers' willingness to commit to Lean goals originates from satisfaction with past organizational change programs (see also Bordia, Restubog, Jimmieson, & Irmer, 2011; Elias, 2009; Locke & Latham, 2002). In sum, when Lean team members show high organizational commitment towards the company's strategic Lean goals high Lean team performance is likely to follow. High satisfaction by Lean team members with previous organizational change programs moderates the link between positive attitudes towards a changeover to Lean and organizational goal commitment.

Team Leadership

Team leaders are generally considered key actors in any team's effort to attain performance enhancement (Zaccaro, Rittman, & Marks, 2001). Hence, we

were surprised that only two studies in our corpus dealt with team leadership. In Delbridge's (1995) participant observation study team leaders monitored the team performance in order to catch opportunities for improvement. One team leader was pro-active and tried to create work pressure by speeding up the line or controlling the radio switch: "when workers had time to chat." This was counterproductive as workers felt exploited and team performance levels went down. In this case, the team leader had felt increased pressure from higher-level managers to improve the productivity. Ooi, Arumugam, Teh, and Chong (2008) concluded that instead of pressuring team members, it is a Lean leader's task to stimulate his or her direct reports to express their ideas, thereby creating in effect non-managerial employee participation.

In general, "team leadership" is seen as one of the Big Five determinants of effective teamwork (Salas, Sims, & Burke, 2005). The impact of team leaders should be clearly differentiated from higher-level managers who play a more distant, strategic role in teams' daily practices (DeChurch, Hiller, Murase, Doty, & Salas, 2010). Team leaders have a direct effect on human team dynamics, for instance through their on-the-spot reinforcements of new or improved customer-focused work practices and intermediation before quarrels escalate into conflicts (Zaccaro, Rittman, & Marks, 2001). A recent review conducted by Morgeson, DeRue, and Karam (2010) echoes well what can typically be found in Lean teams: team leaders affect the social climate, monitor team performance, take appropriate action when results are lagging behind, notice continuous improvement opportunities within the team, acquire team resources, and encourage autonomy. In addition, team leader support intensifies employees' perceived organizational support (Rhoades & Eisenberger, 2002). Conversely, as shown in Delbridge's qualitative case study, a lack of perceived leader support has negative effects on workers' morale and performance. In order to be effective, team leader support may even need to be challenging of the team's extant assumptions, delivered while role-modeling care for their team members (Morgeson, DeRue, & Karam, 2010). In particular, the adoption of a transformational leadership style has been shown to be associated with the development of proactive improvement-oriented behavior among teams, mediated by the establishment of favorable interpersonal team norms (Williams, Parker, & Turner, 2010).

Building on the foregone analysis of the need for "wise" leadership, we propose that the explicit monitoring of team performance by Lean team leaders is likely to lead to high Lean team performance only if such team leaders have empowered their team members to express their improvement ideas and if they show a transformational leadership style.

Reflecting on the Human Dynamics within Lean Teams

Our review has identified nine human dynamics that have a major bearing on the design of effective Lean teams. In further scrutinizing these intra-team

dynamics, one may cluster the factors involved into three types of human team dynamics: affective, behavioral, and cognitive (see, e.g., Bosch-Sijtsema, Fruchter, Vartiainen, & Ruohomäki, 2011; DeChurch & Mesmer-Magnus, 2010; Ilgen *et al*., 2005; Kozlowski & Ilgen, 2006; Marks, Mathieu, & Zaccaro, 2001; Salas, Cooke, & Rosen, 2008). In the "*affective*" category we include those human dynamics that capture "motivational tendencies, relations among team members and affective reactions" (Kozlowski & Ilgen, 2006, p. 87). The "*behavioral*" category constitutes "what teams do – their actions to strive toward goals, resolve task demands, coordinate effort, and adapt to the unexpected" (Kozlowski & Ilgen, 2006, p. 95). Finally, we categorize those human dynamics that guide "task-relevant interactions among team members" as instances of the "cognitive" class (Kozlowski & Ilgen, 2006, p. 81). In other words, in order for team members to behave in effective Lean ways (e.g., sharing information, monitoring performance, innovating and supportive team leadership), they must be in a positive "affective state" (e.g., feel psychologically safe, experience team member support, be able to manage intra-team conflicts as well as nurture a moderate level of team cohesion). In addition, it is essential for team members to be inspired to identify with a clear, specific set of collective (in this case Lean) *cognitive* goal(s) (e.g., commitment to the organizational Lean goals). All these dynamic human factors build upon and reinforce each other in a delicate balance; as was demonstrated in several of the reviewed studies. It takes considerable time and human effort to craft such Lean team "ecosystems" and none of the single studies covered all (or even a majority or creative blend) of the human dynamics indicated herein. Accordingly, in order to advance our understanding of these dynamics, more comprehensive studies are highly recommended.

None of the studies reviewed examined the degree of urgency felt by the team members for moving (effectively) towards Lean. Lean team members may be inspired to embrace Lean by the increasingly varied needs of the external and/or internal customers, but there may be other ways Lean team members are stimulated to start continuous improvement (Locke & Latham, 2002). Clearly, the roles and behaviors of (team) leaders in this respect have not yet been thoroughly scrutinized. According to DeChurch and Mesmer-Magnus (2010) all members of effective teams are assumed to "act" in open-minded yet focused ways. Additionally, members of effective teams must have conflict-management skills as well as the will to inform each other in sufficient ways (instead of playing the "information-is-power" game): both must be geared towards executing ambitious and explicit collective goals.

There is one particular type of employee behavior that seems to be crucial in a Lean team context that has not yet been studied by Lean researchers at all. This behavior is known in small-group literature as voice behavior (LePine & Van Dyne, 1998; Morrison, Wheeler-Smith, & Kamdar, 2011) and it is defined as an "expression of constructive challenge with intent to improve rather than merely criticize" (LePine & Van Dyne, 1998, p. 854). Particularly

in small Lean-type work teams, individual employees are found to speak up more easily to "challenge the status quo" with the purpose of improvement instead of judging (LePine & Van Dyne, 1998). Morrison, Wheeler-Smith, & Kamdar (2011) postulate that the extent to which voice behavior takes place is affected by two beliefs: the employee's feeling that "speaking up is safe in this team" and that "other team members are capable of effective voice." Beginner Lean team members must be trained to use their behavioral skill to give voice to their work-related ideas with the intent of improving their team's performance.

ENABLERS OF LEAN TEAMS

We now review the selected academic literature concerning the enablers of high-performing Lean teams. As in the previous section, we focus on factors that are found more than once, and as far as possible we match them with themes from the broader team-effectiveness literature.

Higher-level Leader Support

In most of the Lean studies, higher-level leader support is seen as a critical factor in the emergence and/or sustaining of Lean in teams; only two of them provided quantitative evidence to support this proposition. In a survey of production workers Ooi *et al.* (2008) found that top-management commitment to Lean was an infrastructural necessity for Lean to be effective (interestingly enough leadership and top-management commitment had no significant effect on workers' job satisfaction). Interestingly, an earlier survey study of TQM practices by Zeitz, Johannesson, and Ritchie (1997) found both higher-management communication and support increased significantly in later stages of successful TQM. Extrapolating from this study it seems that not all higher-level leaders will support Lean immediately; rather, it might take time. If a team is engaging effectively in Lean, its results may convince the remaining senior managers to start embracing Lean.

A recent study found that higher-level NUMMI managers provided Lean support by spending two to three times more time on the shop floor compared to their peers in non-Lean plants (Rothenberg, 2003). As a result, more communication ensued between higher-level management and team members: higher NUMMI managers even provided status updates to their workers about their suggestions. This close manager–worker cooperation evolved as both top managers and employees progressively understood that their futures were mutually dependent. This led to productive cooperation across hierarchical layers, and increased voice and continuous improvement in work floor teams. Other signs of equality at NUMMI included the absence of private managerial offices (except for the president), managers and operators taking their lunch break in

the same cafeteria, good relationships with the unions, and managers dressing informally.

In a multiple-case study design, Waldman *et al.* (1998) reported several other means through which managers displayed Lean commitment and support: communiqués reinforcing quality improvement; talking about quality improvement in staff meetings; listening to employees; and quickly acting upon suggestions. In order to achieve favorable Lean results, a managing director must be a Lean champion – as witnessed in the interviews and multiple-case studies performed by Bateman and Rich (2003) and Bessant, Caffyn, and Gallagher (2001). Such leaders clearly communicate the strategic faith they have in Lean, despite the initial modest results. Indeed, Bateman and Rich (2003) document managerial interviewees stating that the teams of firms whose higher managers continued to promote the strategic importance of Lean kept their "mental focus" on Lean, even in times of crisis. In one of the Lean cases reported by Bessant, Caffyn, and Gallagher (2001), top managers were seen to show a great deal of trust in their non-managerial employees, resulting in goal congruence.

Three studies have investigated the antecedents and consequences of a lack of management support. Bateman and Rich's (2003) interview study of managers noted that not all of the managers supported Lean, which was perceived as an inhibitor of Lean sustainability. The interviewees attributed this lack of support to: managers misunderstanding Lean; their incentive structure; and the internal competition for resources. Indeed, a lack of such goal congruence was exemplified in the action research study by Daniels and Burns (1997). Managers' miscommunication about the importance of certain performance indicators led to less-productive team leader behaviors. Instead of focusing on those prioritized indicators, the team obtained good results on the wrong indicators. Finally, Delbridge (1995) showed how top managers were undermining Lean by putting enormous pressure on team leaders to reach targets no matter what. They even controlled by means of a cord when production workers could listen to the radio.

Other studies of Lean leaders have also implied that the role of higher-level managers is a key to Lean's effectiveness at the non-managerial team level (see, e.g., Found & Harvey, 2006; Found, Van Dun, & Fei, 2009; Kanji, 2008; Kanji & Sá, 2001; Magnusson & Vinciguerra, 2008; Van Dun, Hicks, & Wilderom, 2010). A recent video study of six highly effective Lean middle managers in regular meetings with their direct reports found them especially engaged in active listening, and facilitating team learning (Van Dun, Hicks, & Wilderom, 2010). Listening to employees seems crucial, a judgment supported by the multiple-case Lean team study by Waldman *et al.* (1998). Moreover, highly effective higher-level Lean leaders appear to be more open to contrasting views without displaying self-defensive behavior (Van Dun, Hicks, & Wilderom, 2010), thereby promoting equality in the workplace, similar to that found in the NUMMI case (Rothenberg, 2003). If a given leader's role modelling behaviors

change, this provides a clear signal to the shop floor that the strategic choice of enacting Lean is serious (Beer, 2003). Another closely related but non-Lean study shows that high-performing plant managers may reinforce, through their supportive and respectful behavior (as enacted values), a positive climate of trust and openness in the workplace (Smith, Ashmos Plowman, & Duchon, 2010). Indeed, higher-level leaders are able to create psychological safety so that employees feel free to give voice to their concerns and ideas (Detert & Treviño, 2010): for example, by actively searching for, and structuring information from, employees. The predominantly managerial interviewees in the study by Detert and Treviño (2010) also raised other, more indirect, ways to increase employee voice: symbolic stories, policies, structures and practices. The success of any long-term strategy such as Lean depends on a manager's visible support and commitment to this goal (cf. Mathieu *et al.*, 2008).

On the basis of the foregoing review, we conclude that perceived higher-level leader support for Lean leads to the development of high-performing Lean team dynamics. The Lean studies discussed above provide several ways for managers to show their support for Lean. For example, they are repeatedly and clearly communicating the strategic Lean goal, and being open to contrasting views with little self-defensive behavior. Furthermore, if higher level managers display little power distance vis-à-vis non-managerial workers, a sense of equality may evolve, resulting in a more effective implementation of Lean as well as improved team learning. In light of these conclusions it would be fascinating to further examine the specific behavioral repertoire (including the value constellation) of effective Lean managers across a given organizational hierarchy. In general, there appears to be a fundamental tension, given that not all managers within a firm will adopt the various Lean norms, values, and accompanying behaviors at once (Van Dun, Hicks, & Wilderom, 2010; Waldman *et al.*, 1998), and it seems that high performance results with Lean may help win over the lagging higher-level managers (Beer, 2003). A valuable study would be to trace, over time, the top-managerial strategic deliberations around possibly moving towards a Lean mode of work.

Strategic and Structural Clarity

Nine of the 13 studies noted strategic and structural clarity as keys to effective Lean implementation. Bessant, Caffyn, and Gallagher (2001) observed one case (in a multiple-case analysis) where a company broke down its business strategy into clear-cut goals and CI behaviors: a practice which is also known as "hoshin kanri" (Womack & Jones, 2003). Further, in Delbridge's case (1995), detailed monthly production plans were given to each team leader. Goals were broken down to individual targets and visual control systems were installed for performance monitoring. However, in this case employees felt a low level of psychological safety, an overly high fixation on performance, and little

support from both lower- and higher-level leaders. This case indicates a highly intertwined set of negative enablers and team dynamics.

In an organizational Lean strategy, every work practice is supposed to be directed towards satisfying the (internal or external) customers' needs (Womack & Jones, 1994). Remarkably, only two of the 13 Lean team studies report on a strategic customer focus. Zeitz, Johannesson, and Ritchie (1997) showed that in the eyes of the employees, workers' customer orientation increased, especially in the later stages of Lean implementation. Another study by Ooi *et al.* (2008) found that Lean team customer focus is unrelated to production workers' job satisfaction. Yet, the authors argued that an employee reward system with a direct link to customer satisfaction scores would reflect a much clearer strategic focus on customers; we are skeptical that such a lopsided reward system would truly increase a team's performance in the long term. In any case it is important for managers to be highly articulate about the team's responsibility for a firm's strategy deployment. Ideally, Lean team members should seek to connect their activities to company strategy and customer value. For Lean to be effective, however, Lean must be part of the more-or-less formal, or at least well-discussed, team strategy. We thus propose that when members of Lean teams have embraced a deliberately crafted, specific and firm-wide congruent Lean strategy, they are more likely to show high-performing Lean team dynamics.

Bunderson and Boumgarden (2010) found that team structure can have a significant and positive effect on a team's human dynamics. Similarly, Kauffeld (2006) showed that formal Lean team arrangements led to an increase in: team competence (in terms of structuring and solving problems); the execution of supportive team-oriented activities (such as machine or workplace maintenance and internal supply logistics); participation (i.e., more autonomous decision making); formal team communication (i.e., the number of formal team meetings); and CI process (i.e. team member involvement in CI). What is unexpected and striking is that overall organization structure (i.e. size) did not impact on team competence (Kauffeld, 2006). At NUMMI, Rothenberg (2003) noted a variety of different structures and practices that increased employee awareness of their work context: for example, instant feedback on errors by internal customers and employees' exposure to a greater number of tasks (also outside their own work team). In the longitudinal survey of Mullarkey, Jackson, and Parker (1995) team workers were given more formal product responsibility. As a result, workers' perceptions of individual autonomy (in terms of timing control and method control) increased significantly. After team members had been grouped in U-shaped assembly areas in order to better interact with external customers, a significantly higher level of team autonomy (e.g., regarding production pacing and task scheduling) emerged (Mullarkey, Jackson, & Parker, 1995).

Mullarkey, Jackson, and Parker's (1995) longitudinal study showed that increased worker responsibility may lead to structural clarity. Moreover,

Hackman and Oldham (1976) showed that general work design characteristics such as autonomy, and psychological states such as experienced responsibility, may lead to higher team performance. A related example is a study of a small utility company by Fuller, Marler, and Hester (2006), showing that after workers had been given more access to resources they felt more responsible for constructive change. In turn, this led to more CI and voice behavior.

Based on the foregoing review we suggest that when team members are given more responsibility for the team's performance along with more job and team autonomy, they will act to make Lean a success. The more members of a team who are charged with becoming an effective Lean team have clarity about, and participate in, crafting their own specific team strategy and structure, the more they will develop high-performing Lean human dynamics.

Human Resource Policy

Six of the 13 studies focused on the HR policy as an enabling factor in the success of Lean implementation. Four of these addressed "education and training" for the purpose of enhancing Lean team-worker competence. Although Ooi *et al.* (2008) in their survey found no significant effect of this factor on job satisfaction, Kauffeld (2006) showed that the amount of new task training may enhance competence: for example, problem solving and restructuring the team for optimizing the execution of tasks. Also Rothenberg (2003) illustrates how NUMMI enables education and training for Lean team performance enhancement; when the key role of data-control systems in Lean team workers' routines was recognized, data-analytical skills were soon consciously imparted. In addition to this type of skill training, NUMMI's training for new employees also addressed work attitudes as part of an explicit socialization process (Rothenberg, 2003). Bessant, Caffyn, and Gallagher (2001) in three of their six case studies provide an account of various training programs matching the various Lean stages (as an example: in the Lean implementation start-up phase, tools for basic problem solving had been offered).

Organizational-level Lean studies have asserted that in later Lean phases more advanced shop-floor team training needs to be offered, including the development and training of dedicated CI facilitators (see Jørgensen, Hyland, & Kofoed, 2008). As particularly well illustrated by Rothenberg (2003), effective training of Lean team members is quite involved. Clearly, such training must be embedded in a shared mental model (Uitdewilligen, Waller, & Zijlstra, 2010; Van Den Bossche, Gijselaers, Segers, & Kirschner, 2006), fostering continuous learning and an improvement orientation (Busk Kofoed, Gertsen, & Jørgensen, 2002). Lean training of course is not effective if it does not also include a cognitive understanding of the principles behind Lean (Barton & Delbridge, 2004; Bhasin & Burcher, 2006). Appropriate team training in non-Lean settings has also been shown to improve teams' performance (Salas *et al.*, 2008, p. 926): "team training interventions are a viable approach

organizations can take in order to enhance team outcomes. They are useful for improving cognitive outcomes, affective outcomes, teamwork processes, and performance outcomes." Some of these interventions may effectively take place on-the-job. For example, Hyland, Becker, Sloan, and Jørgensen (2008) have studied how HR professionals helped with the sustaining of on-the-job Lean practices. Further studies could examine the extent to which the education and training of team members significantly contributes to the development of high-performing Lean team dynamics. De Menezes, Wood, and Gelade (2010) have already found a positive, organization-wide effect of "Leaning" HR practices (see also Shah & Ward, 2003).

Other HR type policy enablers of Lean team performance have been studied, although with less rigor than the education and training factor. The majority of studies that focus on employee selection processes or reward systems concern (multiple) case studies (see Bessant, Caffyn, & Gallagher, 2001; Delbridge, 1995; Rothenberg, 2003) or have included these factors merely as single survey items (see Ooi *et al.*, 2008; Zeitz, Johannesson, & Ritchie, 1997). Rothenberg (2003) stresses the need for a well-designed employee selection process, including a series of psychological and cognitive tests. At NUMMI, the aim was to select employees who fit NUMMI's cooperative spirit (see also Uitdewilligen, Waller, & Zijlstra, 2010). An organizational-level study of the HR function at Toyota stresses that careful selection and development of workers underpins the use and value of Lean (Liker & Hoseus, 2010).

Another HR-type enabling factor is job security (Rothenberg, 2003). NUMMI's workers who otherwise would have been fired were transferred to other departments. They felt supported by the no-layoff policy, and became more willing to participate in knowledge sharing activities. Furthermore, in two of their six case studies Bessant, Caffyn, and Gallagher (2001) pointed to the entire range of potential effective rewards. In Delbridge's participant observation study (1995) an individual quality performance tracking system, based on the measured quality of the output, gave warnings to individual workers. After several warnings and a lack of improvement, individual workers could be dismissed (Delbridge, 1995). Moreover, a clear absenteeism policy was strictly enforced (Delbridge, 1995).

In terms of team rewarding, Zeitz, Johannesson, and Ritchie (1997) stress that rewards must also lead to a high level of fairness. Indeed, in team-effectiveness theory, fair rewarding (i.e., outcome justice) is a known factor in the shaping of Organizational Citizenship Behaviors (OCBs) (De Cremer *et al.*, 2010). Nevertheless, in times of uncertainty it was found that procedural justice led to more OCB than did outcome justice (De Cremer *et al.*, 2010). Williams, Pitre, and Zainuba (2002) found that the perceived fairness and respect from higher-ups (procedural fairness), more than fair rewards *per se* (outcome fairness), may lead to effective extra-role behavior. Beyond fairness in reward procedure and outcomes, consistency when providing rewards is also known to be very important. Similar to the NUMMI case example

(Rothenberg, 2003), at Toyota, job security and the absence of repercussions after admitting mistakes garnered a high level of trust between management and workers (Liker & Hoseus, 2010). Gürerk, Irlenbusch, and Rockenbach (2009) showed that consistency in rewards (given by a team leader and/or the organization at large) affects a team's culture and climate through the shaping of team norms and values. Salas, Sims, and Burke (2005) argue that after a leader introduces (or reinforces existing) team task norms (e.g., through a fair and consistent reward system), intra-team human dynamics will emerge that steer individual team members' behavior towards these team norms (and these may encompass nonconforming team member behavior). We thus propose that when a fair and consistent reward structure is provided, high-performing Lean team dynamics are likely to emerge, and this relationship will be moderated by perceived higher-level leader support.

Given that the aim of performance measures and rewards is to stimulate high performance, the question raised is how balance between individual and team rewards in Lean teams is achieved. When a team has high task interdependence, initial team-level performance rewards will lead to the development of high-performing Lean team dynamics. This proposition is based also on Wageman and Baker's (1997) study. They noted that team-level reward systems led to higher team performance than mixed reward systems with equally divided team- and individual-level rewards. The latter, they persuasively argued, sends out mixed signals about the firm's strategic choices. However, anonymous team-level reward systems work through peer pressure, which may not succeed in cases of social loafing (Kahai, Sosik, & Avolio, 2003), or if team members do not value the obtainable benefits (Bendoly *et al.*, 2010). On the other hand, Bateman and Rich (2003) reported managerial change agents who implemented purely individual productivity measures that inhibited CI-supportive behaviors. More recently, Pearsall, Christian, and Ellis (2010) found hybrid systems (combining individual performance rewards with team incentives) to be best, given the reduced risk of social loafing. In the case of high-performers who function as role-models and train their underperforming colleagues on-the-job, individual-level performance measurements may invoke team learning.

Resource Abundance

Two studies stressed the availability of resources as crucial in effective Lean implementation. Bateman and Rich (2003) noted that when firms were able to grow in size they were more successful in maintaining the activities related to continuous process improvements. They also found that Lean team workers were enabled by resources such as temporary additional workers and the authorization of overtime; this made it possible to create and follow-up on improvement initiatives. Bessant, Caffyn, and Gallagher (2001) described how two full-time CI facilitators were active in developing a structured approach to

CI implementation. Another typical Lean investment is the creation of dedicated team spaces to facilitate CI-focused team meetings around a whiteboard and performance dashboards. Indeed, Siemsen *et al.* (2009) show that when managers reserve appropriate temporal and spatial types of resources, team members will interact more; and by doing so they will develop higher levels of psychological safety.

Although at first sight the spending of resources on Lean may seem to fly in the face of a Lean ethos, investing in improvement activities shows employees that Lean is both serious and important. In contrast, if a firm is at a stage of only cutting costs, one cannot count on much employee willingness to come up with or implement improvement ideas. The Toyota philosophy is built around respect for employees (Liker & Hoseus, 2010; Toyota Material Handling Europe, 2010) which results in investing in people and their ideas for improvement, rather than cutting them back. Hence, it is more likely that growing firms will start to engage effectively with Lean than firms without a growth strategy. By implication, Lean teams which lack access to resources will be less effective than similar teams with more access. The development of high-performing Lean team dynamics cannot occur without deploying adequate context-specific resources such as time and space.

A Reflection on the Studied Enablers of Effective Lean Teams

Enablers of effective Lean team functioning have not received much empirical research attention. Thus far, there are only four pertinent enablers (higher-level leader support, strategic and structural clarity, Human Resource policy, and resource abundance) that have been examined. One key enabler not receiving much research attention to date is job challenge. Zeitz, Johannesson, and Ritchie (1997) found that job challenge significantly increases when TQM programs are more developed compared to ones just started. The authors hypothesized that the more the job challenge, the more employee suggestions are raised and implemented (a form of information sharing). Within Lean firms leaders strive for more challenging, optimized work situations (see, e.g., Delbridge, 1995). Although mistakes may start to occur as soon as leaders orchestrate job challenge, it is also likely to release a much richer set of local ideas and solutions (Choo, 2011). Such knowledge creation in turn enables team learning opportunities which may result in further optimization of work practices.

Becoming Lean is shown to be very involved; serious Lean team effort clearly requires managerial, strategic, staff, and also material support. It demands a long-term investment of various organizational resources. If one combines this insight with top management's conventional short-termism (Porter & Kramer, 2011), it helps explain why so few successful Lean teams exist or succeed. Clearly, institutionalizing Lean on the shop floor requires a change of culture that few firms seem skilled at executing, even if they want to. In other words,

many of the businesses in dire need of performance improvement at the operational team level lack the higher managerial skill and will to implement Lean: a prime obstructer to reaping the potential results of effective Lean operational teams. The more top managers are concerned with only their own, short-term legacy, the shorter their firm's strategic horizon. In these circumstances it is less likely that Lean will be started or sustained.

TOWARDS MORE LEAN TEAM CULTURES

The enablers we have found in the Lean team studies overlap to a large extent with factors that help shape an effective organizational culture; leader behaviors have especially been noted as the key to culture change (e.g., Ford, Wilderom, & Caparella, 2008; Hatch, 2011; Schein, 2004; Spicer, 2011). One may define organizational culture as a "fairly enduring multileveled, organized work context entailing the following: organizing values, norms, taken-for-granted assumptions, behavioral regularities, rituals, practices, procedures, patterns of discourse, use of symbols, ways identity is constructed" (Ashkanasy, Wilderom, & Peterson, 2011, p. 4). In everyday practice, only some teams or organizations succeed in congruently changing this set of features. Due to the high degree of interrelatedness of these features and the fact that they are so all-encompassing, the change conditions in place – also for single teams – seem largely top-managerial in nature. It is well-documented though that organizational culture change efforts on the part of top management are normally slow and often fail (Jorritsma & Wilderom, 2011; Mackelprang & Nair, 2010). One explanation is top managers' overconfidence, evidenced in their failing to see inadequacies in ("selling") their own plans (Shipman & Mumford, 2011).

The question then is: what enablers need to be in place, including those residing within a given team culture, to facilitate effective Lean team cultures? There is a noteworthy absence of studies on the self-moving of a given team culture into Lean. Kekäle, Fecikova, and Kitaigorodskaia (2004) have already noted that if a company seeks to implement Lean principles, its approach may need to differ among its various departments and teams, in order to accommodate the various existing subcultures (see, also, Detert, Schroeder, & Mauriel, 2000). Even in organizational cultures that are considered to be strong, there are reports of cultural differences between subgroups (Adkins & Caldwell, 2004; see also Bryson, 2008). The lack of scholarly attention to the existence of lower-level organizational subcultures (Hofstede, 1998) underscores how limited our current theoretical understanding of a Lean team culture is. This weakness is compounded by the fact that the great majority of Lean studies focus on organizational (or even industrial or national) level Lean culture or behaviors. Clearly, we need a greater understanding of these work-team level cultures. Moving a given team constellation or regime into an effective Lean team culture invariably involves a complex interplay of the

enablers. Within the strategic boundaries set by higher-level leaders, the team develops certain human dynamics. The exact process or sequence of how these dynamics evolve will differ from team to team (Aloini, Martini, & Pellegrini, 2011), since each has its own team culture as a starting point. As we have seen, what is crucial are the ways in which enabling (leader) practices are deployed and come across in the eyes of non-managerial work team members, that is, the perceived sincerity with which the strategy gets implemented by higher and lower level leaders. Scholars often argue that team culture evolves only gradually over time, being subject to external forces such as mergers, new operators who join a team, stakeholders' opinions, or (team) leaders' behaviors (Hatch, 2011; Schein, 2004; Spicer, 2011). Indeed, there is a great variety of exogenous means through which the four types of enablers that were found in the empirical Lean team studies manifest themselves. True cultural change on the team level takes place after (in part intuitive) reflection (on the new exogenous and endogenous forces) on the part of both team members and team leaders (see also Howard-Grenville, Golden-Biddle, Irwin, & Mao, 2011).

We have visualized a basic model of the evolvement of an improved Lean team culture (see Figure 5.1). The path towards such a culture involves a team with an adequate level of team performance. Over the course of its existence this idealized team has (or is) a set of values, norms, rituals, behaviors, practices, and so forth (i.e., a team culture). As a first step to enable the effective implementation of Lean in such an operational team, (higher-level) leaders must embrace the Lean ideology as a part of their organizational or team strategy. Before Lean is effectively employed, managers must act as role models and thus express – also through their behaviors – the Lean values. Other enabling factors that must be set in place include: structural and strategic clarity; the involvement of HR to design congruent worker profiles and recruitment strategies compatible to Lean management; as well as the availability of time, training, and other types of team resources. Whenever these Lean enablers are put in place, team members are exogenously facilitated to play out the human dynamics of a high-performance Lean workplace team.

The degree to which Lean team dynamics can evolve endogenously is equally intriguing, and as far as we know to date has never been reported on. In line with the team-effectiveness literature, we categorized the nine human dynamics into three categories: affective, behavioral, or cognitive (see, e.g., Bosch-Sijtsema *et al*., 2011; DeChurch & Mesmer-Magnus, 2010; Ilgen *et al*., 2005; Kozlowski & Ilgen, 2006; Marks, Mathieu, & Zaccaro, 2001; Salas, Cooke, & Rosen, 2008). A team's change is surely to begin the moment that one or more of the Lean enablers are introduced. Some of the change proposals are then being reinforced (or rather reinterpreted) by team members who after some reflection may (dare to) improvise (in part intuitively) with the given set of new and old resources (and dynamics). If an (even slightly) altered state-of-affairs shows team members that Lean is beneficial, Lean gets reinforced

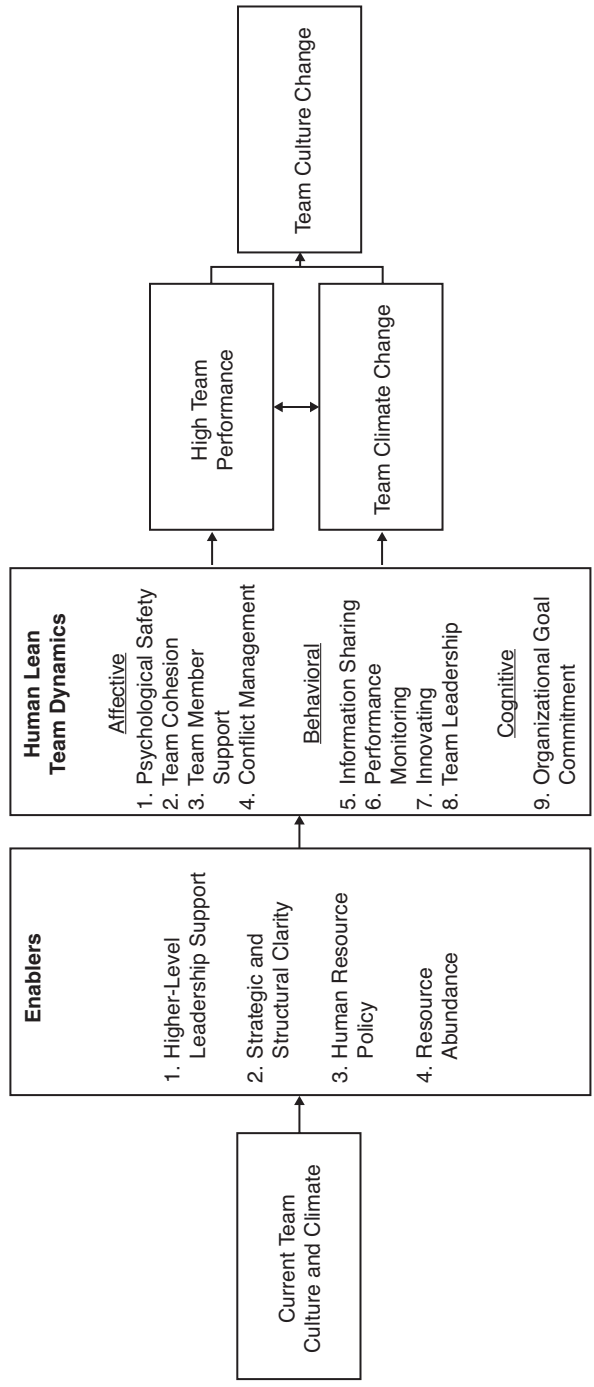

Figure 5.1 Hypothetical model on evolving a team towards a Lean team culture

and later more firmly entrenched. In other words, Lean team performance improvements, including the perhaps slightly felt improvements on the part of key employees, may help to embed the Lean values, norms, rituals, behaviors, and practices into the more deeply-rooted team culture. Hence it may take a while before a team has engaged in the deeper internalization of the Lean mindset. If a successful embedding of Lean has taken place it is likely that the team is more capable of collaborating in team tasks; responding to customers' changing needs; and engaging in ongoing improvement of their daily work practices.

The culture-change process described herein has a strong affinity with the process of climate change. Team climate has a transient, team mood-state of nature. Hence, a team's climate change is likely to have begun already the first moment new contextual enablers are being introduced. In other words, a Lean team's climate is affected even before the Lean team enablers are becoming institutionalized. It seems reasonable in this circumstance to speak of "climcult" change (Schneider, Ehrhart, & Macey, 2011a, 2011b); effectively becoming a Lean team in the long term requires iterative reflection about both visible (e.g., available resources) and more tacit (e.g., habits and norms) organizing ingredients: carried out by reflecting and improvising, goal-driven team members and their leaders. When at the same time the external enablers (summarized in this chapter) are well deployed, this will facilitate the development of positive Lean team dynamics, which in turn anchors Lean work habits in a team's culture.

In sum, managers can indeed not manage, but merely facilitate, or enable, the self-evolvement of a Lean team's culture and climate. In other words, the members of the Lean teams themselves affect their climate and culture by reflecting on and slightly modifying their culturally-rooted team dynamics on a day-to-day basis (see Howard-Grenville *et al.*, 2011). The degree to which they are effective in doing so depends to some extent on how higher managers enable their change initiatives. This enabling mode is markedly different from *managing* culture change in a team; we believe that culture change cannot be completely managerially controlled. Organizational members will not easily let go of their self-crafted practices, beliefs, and values (Schein, 1990); resistance will be especially evident if they feel excessively or irrationally forced by their managers. Some firms have applied tools to enable a constant-change culture in favor of Lean: see, for instance, the various tools noted by Anand *et al.* (2009) – visually appealing dashboards, value stream mapping, and workshops with managers. Furthermore, the more advanced Lean firms have internalized an efficient mindset to such a degree that they may not even formally label their way of working as Lean (Bessant, Caffyn, & Gallagher, 2001). Similarly, the principles of the Toyota Production System have been incrementally developed over several decades and as a result are deeply ingrained into the DNA of its workers (Holweg, 2007; Spear & Bowen, 1999). A Lean-team culture is thus crafted when team members change their own work practices or basic beliefs and values through voluntarily participating in a learning or improvising

process, which may be enabled by the goal to have Lean practices (Santos-Vijande & Álvarez-González, 2007). In other words, a Lean team culture is hand-crafted through a continuous joint effort of both higher-level leaders, team leaders and team members (see also Ford, Wilderom, & Caparella, 2008). Achieving long-term operational excellence within teams at the bottom of organizational pyramids is thus a path that takes determination, significant investment of resources and a long-term view. Hence, an equally enduring or longitudinal, mixed-methods type of Lean team research trajectory in this vein is recommended.

FUTURE RESEARCH DIRECTIONS AND REFLECTIONS

Although we applied strict criteria with regard to the academic quality of the selected studies, the sample included predominantly qualitative case studies. Rothenberg's (2003) NUMMI case, for instance, provided a narrative on how Lean work practices were employed on the shop floor. To be frank, we had expected more academic rigor in these Lean studies. Going forward, we need more conceptual rigor; richer detail in the hypotheses and in the reporting of the methods employed in Lean team studies in order to lift the entire field. Also, there is a lack of longitudinal, hypothesis-testing. We would especially welcome more studies such as the study of Mullarkey, Jackson, and Parker (1995).

Given the near absence of behavioral Lean research at present, we still know very little about the patterns of behavioral dynamics operating over time in high-performing Lean teams. This was one of the main reasons why, in this chapter, we also leaned on the team-effectiveness literature. Naturally, other theoretical content, such as that on small groups, team learning, team climate, and team identity, would contribute to refining the insights distilled from the current review. For example, we might question the extent to which Lean team studies' findings are unique to Lean teams; highly performing Lean teams may have a different "cultural content" (Ford, Wilderom, & Caparella, 2008) than comparable non-Lean teams. But, other than that, their dynamics and enablers may be similarly intertwined. One would expect some content to work out differently in a Lean context. Exactly which cultural content of Lean teams differs significantly from similar non-Lean teams remains to be seen.

The ways in which Lean studies assessed team performance is another clear point of future-research concern. Only six of the 13 studies actually measure performance, of which the most prominent measure is team members' "job satisfaction" (see Godard, 2001; Jackson & Mullarkey, 2000; Mullarkey, Jackson, & Parker, 1995; Ooi *et al.*, 2008). Other indicators of Lean team performance include: team learning orientation (Bunderson & Boumgarden, 2010); job-related strain (Jackson & Mullarkey, 2000); general strain, job-related anxiety,

and job-related depression (Mullarkey, Jackson, & Parker, 1995); self-esteem, commitment, and motivation (Godard, 2001); and team competence (Kauffeld, 2006). Hence, performance is measured mainly from the employee perspective. The fact that none of the studies reviewed in this chapter measured whether customers or other actors within the organization benefited in any way from Lean implementation is remarkable. This is especially so given that the studies were performed in for-profit firms, in which Lean operational work is supposed to increase customer value. Moreover, none of the 13 studies reviewed examined *internal* customers (i.e., customers close to the focal teams, from whom it is easier to extract performance data). Accordingly, we urge scholars to take up this challenge and start collecting objective, team-level performance data, with measures such as productivity, efficiency, and (internal) customer satisfaction. This would lead to a more complete understanding of the effects of the human dynamics and enablers of Lean teams.

In summary, we reviewed the best available studies of Lean operational work teams in commercial firms, focusing on how best to enable effective human team dynamics. Moreover, as any movement of a firm or team toward the Lean ideology entails a climate and culture change, we included some insights into team culture and climate change in general. Given the paucity of rigorous empirical studies on changeovers toward or crafting Lean workplace team cultures and climates, there is an urgent need to conduct such longitudinal types of studies (Salas, Cooke, & Rosen, 2008). Accordingly, we call for in-depth studies that closely observe and codify a prospective change towards (a next phase in) Lean team cultures and climates. At present, there is a huge discrepancy between the numerously uttered pleas for culture change (even in strategy statements) and the number of actual field studies of work floor teams becoming Lean. Systematic study showcasing those workplace teams that do proceed with their Lean journey (including those that seem to fail) will provide managers and change agents with valuable knowledge about successful Lean implementation. Ideally, such work would enable practitioners to improve their approaches and at the same time inform us about the empirical facts not easily seen with the naked eye. The study of Lean work-floor settings might, furthermore, uniquely aid in the forming of theory on how increasingly productive teams work: the moving holy-grail target for many of us who care for sustainable and continuously improving work practices.

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