Lean innovation training and transformational leadership for employee creative role identity and innovative work behavior in a public service organization

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Abstract

Purpose – With the growing need for employees to be innovative, public-sector organizations are investing in employee training. This study aims to examine the effects of a combined Lean Six Sigma and innovation training, using action learning, on public-sector employees' creative role identity and innovative work behavior.

Design/methodology/approach – The authors studied a public service agency in Singapore in which a five-day Lean Innovation Training was implemented, using a combination of Lean Six Sigma and Creative Problem-Solving tools, with a simulation on day one and subsequent team-based project coaching, spread over six months. The authors administered pre- and postintervention surveys among all the employees, and initiated group interviews and observations before, during and after the intervention.

Findings – Creative role identity and innovative work behavior had significantly improved six months after the intervention, enabled through senior management's transformational leadership. The training induced managers to role-model innovative work behaviors while cocreating, with their employees, a renewal of their agency's core processes. The three completed improvement projects contributed to an innovative work culture and reduced service turnaround time.

Originality/value – Starting with a role-playing simulation on the first day, during which leaders and followers swapped roles, the action-learning type training taught all the organizational members to use various Lean Six Sigma and Creative Problem-Solving tools. This nimble Lean Innovation Training, and subsequent team-based project coaching, exemplifies how advancing the staff's creative role identity can have a positive impact.

Keywords Lean innovation training, Action learning, Creative role identity, Innovative work behavior, Transformational leadership, Longitudinal, Mixed methods

Paper type Research paper

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1. Introduction

Many public-sector organizations around the world struggle to maintain customer value and reduce organizational bureaucracy (Bason, 2018; Lukrafka *et al.*, 2020). One way to solve this problem is to engage staff in innovating and delivering high quality services in a cost-effective manner, as well as meeting growing external expectations and demands (Bason, 2018; Elliott, 2020; Suseno *et al.*, 2020). To respond to such demands, some organizations have adopted operational excellence, i.e. continuous improvement and innovation strategies (Lukrafka *et al.*, 2020). Over the last decades, Lean Six Sigma (LSS) has become a worldwide popular operational excellence methodology, including in public-sector organizations, for improving customer/public satisfaction, reducing costs, speeding up processes and maximizing stakeholders' value (Alblooshi *et al.*, 2020; Antony *et al.*, 2017a; Antony *et al.*, 2016; Sreedharan and Raju, 2016).

Despite the recognition of the benefits of LSS on employees' continuous improvement practices and mindset shift and its positive influence on organizational performance (Antony *et al.*, 2017a; Price *et al.*, 2018; Rodgers and Antony, 2019), research on underlying individual employee behaviors and related attributes have been rather neglected in the LSS empirical literature (Stanton *et al.*, 2014). Apart from a few opinion pieces which focused on human resource issues for LSS implementation in the public sector (Antony *et al.*, 2016; Rodgers and Antony, 2019), no rigorous empirical evidence has emerged of the role of individual behaviors, such as innovative work behavior (IWB) (Mutonyi *et al.*, 2020; Suseno *et al.*, 2020), in the LSS implementation process (Zhang *et al.*, 2012). Although many scholars have called for testing behavioral theory in public service organizations (Adam *et al.*, 2021; Chaubey *et al.*, 2022; Suseno *et al.*, 2020), studies on the effects of LSS and/or innovation-type of training among public-sector employees are still scarce (Chaubey *et al.*, 2022; Dostie, 2018).

In fact, previous studies by Bysted and Jespersen (2014) found that the effect of training and development practices on employee's IWB is lower in public-sector organizations than in private-sector organizations, especially regarding idea generation and the realization of ideas. They explained that public-sector employees are generally more educated than private-sector employees and, therefore, a training targeted at integrating knowledge across the organization needs to be purpose driven and practical to advance its effect on employees' IWB. According to Borins (2001, 2009), public-sector organizations have traditionally been seen as inhospitable to innovation, with their internal reward systems being averse to selecting innovative individuals. Yet, despite their prototypically inhospitable environment, a growing body of evidence is pointing to the fact that public service employees are increasingly becoming responsible for innovation (Juliani and de Oliveira, 2021; Moussa *et al.*, 2018; Sørensen and Torfing, 2011). Hence, our research aims to examine the longitudinal effect of a practical, action-learning style of training intervention that combined customer-oriented LSS and Creative Problem-Solving (CPS) in a Singapore public service agency.

Combining LSS and CPS toolboxes can lead to a holistic improvement methodology for organizations, as applying only LSS is not generally the best method for identifying disruptive innovation opportunities (Antony *et al.*, 2020; Antony *et al.*, 2017b; Hoerl and Gardner, 2010; Lameijer *et al.*, 2021). Furthermore, a longer LSS training period can be a burden to organizations (Lameijer *et al.*, 2021) and might not be fast enough considering how quickly the external environment is changing. Thus, we deployed a so-called action-learning-based Lean Innovation Training (LIT) to ensure public service sector employees' acceptance of LSS (Antony *et al.*, 2019; Lameijer *et al.*, 2021), as will be elaborated in Section 2.2. The action-learning approach nudges employees to solve problems by openly

seeking new opportunities while reflecting upon their work results (Cusins, 1996; Marquardt *et al.*, 2018; Powell and Coughlan, 2020). While most of the studies investigating innovation-enhancing type of trainings are limited to mere pre- and posttraining assessments of creative-performance interventions (Scott *et al.*, 2004), we examined the key conditions for durable LIT effects.

Research on learning curves showed that an acquired skill tends to diminish over time (Meinel *et al.*, 2019), often due to lack of support while applying what has been learnt. Other enabling conditions, such as the senior managers' leadership, must thus be considered (Chaubey *et al.*, 2022). Next to an organization's leadership style (Seidel *et al.*, 2019), we examined one other condition for effective LIT of public-sector employees: creative role identity (CRI, Farmer *et al.*, 2003; Wang *et al.*, 2014). Prior studies demonstrated that employees are more likely to internalize and display IWB if they perceive that such behavior is valued and expected by their leaders (Farmer *et al.*, 2003). Therefore, we looked at the impact of senior management's transformational leadership style (TFL, Bass, 1999) on employees' CRI and, in turn, IWB: before, during and after the LIT. Our main research question was:

RQ1. How can an action-learning-based Lean Innovation Training of managers and employees in a public-sector organization enhance employees' creative role identity and innovative work behavior over time?

Antony *et al.* (2020) and Lameijer *et al.* (2021) urged for the traditional LSS training program to be restructured with a more focused and practical training approach to make it more acceptable and adoptable by organizations which already have a somewhat elevated level of continuous improvement and innovation capabilities. Hence, we chose a Singaporean public-sector organization for this study because the public sector in Singapore has a relatively mature awareness of continuous improvement and innovation capabilities [1]. Singapore, like many other advanced economies, is facing the specter of a shrinking labor force which raises the need to increase productivity through promoting innovative work practices, upskilling the workforce and improving organizational processes. Below, we first review the relevant theory, after which we present the intervention and the data-collection and -analytical procedures. Subsequently, we report the Results, and the Discussion section sketches the theoretical and practical implications, including future-research recommendations.

2. Literature review

2.1 Public sector employee creative role identity and innovative work behavior

Role identity refers to an individual's view of the self in a specific function (Ashforth and Schinoff, 2016). According to the role identity theory, role-consistent behaviors reconcile the self-views of an individual with the perceptions of others, thereby reinforcing that individual's role identity (Karwowski and Kaufman, 2017). Individuals tend to behave in accordance with their role identities (Woodman and Schoenfeldt, 1990). As role identities are validated and maintained through role-consistent behaviors (Karwowski and Kaufman, 2017; Petkus, 1996), individuals with strong CRIs are likely to be more creative. Employees with a stronger CRI tend to pay greater attention to identity-verifying information and have more interest in creative tasks. Farmer *et al.* (2003) found that an individual's self-view of creative behavior significantly contributes to the development of a CRI.

In general, an employee's decision to engage in IWB is preceded by their estimation of a positive response from one's work environment to such actions (Maitlis, 2005). IWB can sometimes be seen as "rocking the boat" and employees' ideas can upset the managers and

coworkers because they disrupt existing routines (Cheng and Hong, 2017; Janssen *et al.*, 2004). Thus, if a public-sector employee perceives their context to be unreceptive to creativity and innovation, which is often the case in the more bureaucratic public sector, they will judge that developing more innovative services could expose them to negative feedback and feelings of personal rejection. As a result, the employee will avoid IWB (Al Hosani *et al.*, 2021; Bos-Nehles *et al.*, 2017).

On the other hand, if such an employee were to score high on CRI, he or she may personalize any feedback regarding the value of creativity (Farmer *et al.*, 2003): the perceived risks go beyond the loss of tangible rewards; it entails a potential loss of self and identity. A study by Al Hosani *et al.* (2021) with (senior) managers from different public service organizations in the United Arab Emirates pointed to an individual's creative self-efficacy and risk-taking as strong determinants for an employee's IWB. Thus, if public-sector employees are motivated to develop the necessary skills and are inspired to change and learn, they are more likely to engage in IWB (Al Hosani *et al.*, 2021; Mutonyi *et al.*, 2020). Additionally, upon surveying 302 public preschool teachers, Lee and Kemple (2014) found that if the teachers had experienced creativity in their jobs, they were more likely to have positive views on creative teaching practices and encourage it. And public-sector employees with a high CRI tend to stimulate themselves to keep innovating their services that may lead to increases in citizens' satisfaction and trust (Al Hosani *et al.*, 2021; Bos-Nehles *et al.*, 2017; Mutonyi *et al.*, 2020).

Indeed, according to Woodman and Schoenfeldt (1990) and Farmer *et al.* (2003), the interaction effect of experiencing both a creativity process (i.e. witnessing the development of an idea into an implementable solution) and CRI may stimulate employees' CPS and IWBs. Similarly, Zhang *et al.* (2022) discovered that the individual CRI of 60 university staff members moderated the link between individual creative team mindset and innovative behavior. Hence, when (public-sector) employees are enabled to modify their viewpoints through a shared learning and action-based innovation experience, they can reinforce each other's IWB and work more creatively together. This can further stimulate the group's psychological safety for risk-taking, which may increase an individual's potential for innovation (Fenner *et al.*, in press; Hülsheger *et al.*, 2009; Van Dun and Wilderom, 2012), and thus CRI.

2.2 Training interventions for creative role identity and innovative work behavior

In the LSS and innovation domains, various field-training interventions were demonstrated to have positive effects on employees' CRI and IWB. For instance, LSS training facilitates employees' learning and attainment of project management and structured problem-solving techniques (Alblooshi *et al.*, 2020; Antony *et al.*, 2019). The LSS define, measure, analyze, improve and control (DMAIC) phases can guide rational decision-making and improve organizational routines and processes. Once employees have mastered the LSS tools, through experiencing them in structured problem-solving projects, they are likely to sustain IWBs (Antony *et al.*, 2019).

Likewise, creativity training can enhance employees' divergent thinking and problem-solving abilities (Scott *et al.*, 2004). Puccio *et al.* (2020) studied 114 problem-solving groups and illustrated how creativity training can hone the quantity and novelty of the ideas and solutions developed by them. Another study by Chaubey *et al.* (2022), of 346 full-time car manufacturing employees, showed how CPS training was perceived as organizational support for harnessing individual creativity, innovative potential and actual job-related problem-solving.

As Bisgaard (2008) explains, innovation can be either incremental innovation – making modest enhancements to existing products or services or radical "disruptive" innovation – delivering something totally new to the marketplace. While LSS can certainly identify opportunities for incremental innovation, it is not designed for developing ideas to deal with disruptive innovation. Thus, combining LSS with CPS techniques seems promising. For instance, during the DMAIC Improve phase, project teams could apply CPS techniques to help them develop more innovative ideas to have the desired, more radical, impact on process or service performance (Hoerl and Gardner, 2010; Kaufmann, 2012; Mohaghegh and Furlan, 2020). Although one would normally not associate disruptive innovation with public services, there are various possible applications. Health-care costs could, for instance, be potentially reduced by introducing telemedicine, surgical robots and virtual patient visits, whereas digital and blended learning approaches have already enabled the personalization of learning experiences without increasing the number of teachers (Eggers *et al.*, 2012).

Table 1 provides an overview of the LIT approach, based on the DMAIC cycle, in comparison with LSS. On top of teaching a selection of lean (e.g. value stream mapping and takt time) and six sigma tools (e.g. the project charter, SIPOC [2], voice of the customer), we include creativity and innovation tools such as reverse brainstorming and SCAMPER [3]. We have adopted the five-phased DMAIC cycle to provide a systematic, structured method of LIT project management. Instead of the typical ten LSS training days (Lameijer *et al.*, 2021), our LIT entails five days and an increased focus on action learning and coaching in between the training days, to affect significant process improvements as well as employees' motivation to participate in the innovation. The training is relatively short because the advanced statistical analyses (that are normally taught in LSS trainings) have been taken out, which narrows the lean tools selection down (see Table 1). Having a shorter duration increases the chance of the proposed training being accepted by the managers and employees in the public sector (Antony *et al.*, 2019; Antony *et al.*, 2017a; Lameijer *et al.*, 2021; Rodgers and Antony, 2019). A longer LSS training period can be a burden to an organization (Antony *et al.*, 2017b; Lameijer *et al.*, 2021) and might not be fast enough considering how quickly the external environment is changing. Combining LSS and CPS tools potentially increases the deliverance of the coveted results; they can lead to efficient, effective and innovative solutions (Antony *et al.*, 2020; Antony *et al.*, 2019; Hoerl and Gardner, 2010). Nevertheless, few studies have reported the effect of combining LSS and CPS (Alblooshi *et al.*, 2020); in the present study, we highlight their joint effects.

Apart from the training content, its design and methodology are assumed to play an important role as well. More conventional training and development practices for IWB were shown to be less effective in the public sector because of staff's high educational level (Bos-Nehles *et al.*, 2017; Bysted and Jespersen, 2014). In their meta-analysis of 70 training programs, Scott *et al.* (2004, p. 361) revealed that "more successful programs were likely to focus on the development of cognitive skills and the heuristics involved in skill application, using realistic exercises appropriate to the domain at hand." Indeed, according to Cusins (1996), Marquardt *et al.* (2018) and Powell and Coughlan (2020), action-learning methods that encourage people to solve real work problems after acquiring relevant knowledge, while supporting each other's learning, can lead to productivity improvement and new products and services. Integrating various (discrete cognitive experiential) activities into staff training programs can enhance employees' belief in their own creation of solutions for problems. Their analytical and judgmental skills to come up with solutions for similar issues in the future can thus be enhanced through training (Chaubey *et al.*, 2022). We show here how public-sector employees' innovative behaviors can be trained and sustained over

Dimension	LSS green belt	LIT
Training duration	Ten training days, spread over four to six months with two to three days per workshop	Five training days, spread over three months with the first workshop taking two days and the remaining three workshops each one day
Training focus	Developing individuals (often high potential talents) to attain belts or levels of accreditation. This pool of belts forms a resource infrastructure for the organization to build and sustain a continuous improvement and quality culture	Building an excellence mindset and innovation culture by involving members across different functions to learn and encourage creativity and cocreating solutions, scanning future trends, distilling stakeholders insights and reframing challenges, and thus changing their behavior and confidence to experiment
Change management	Change is focused on belts leading projects along with team involvement	An action-learning approach which includes joint participation by project sponsors, team leads and team members and learning related to managing change for the stakeholders
Approach and structure	Project focused training using the DMAIC roadmap for deployment, which uses (advanced) statistical and analytical tools	Project focused training using the DMAIC roadmap for deployment (using basic statistical and analytical tools) and action learning that also emphasizes the implementation of improvement ideas and long-term change management
Project focus	Process variation and turnaround-time-related issues	Turnaround-time related issues
Tools trained in each DMAIC phase	*Define:* Project charter, SIPOC process map, voice of customer, Kano analysis and stakeholder analysis *Measure:* Sample size and confidence intervals, bar/column chart, box plot, histogram, scatter plot, Ishikawa diagram, process performance metrics (customer satisfaction, defects per million opportunities, yield, sigma level and process efficiency), Gage R&R (attribute and ANOVA) *Analyze:* Deployment flow chart, Spaghetti flow chart, value stream map, seven wastes, takt time calculation and process efficiency calculation, regression analyses, hypothesis testing (*t*-tests, one-way ANOVA, *F*-test, Barlett test, Levene test, two-proportion test and chi-square test), design of experiment *Improve:* Brainstorming, failure-mode-effects-analysis, stakeholder analysis and communication plan, change management plan *Control:* Process management plan, process management with attribute control charts (np-charts, *p*-chart, c-chart, u-chart), process monitoring with variable control charts: I chart, X-bar chart, R chart, EWMA chart, CUSUM chart, ROI analysis and statistical proof of improvement	*Define:* Project charter, voice of customer, Kano analysis, stakeholder analysis, *idea box* and *future scenario* *Measure and Analyze: Future scenario,* SIPOC process map, value stream map, seven wastes, takt time calculation, process efficiency calculation, bar/column chart, box plot, scatter plot, basic hypothesis tests (simple linear regression, *t*-test and two-proportion test) *Improve:* Brainstorming, *Webbing, analogies, SCAMPER, idea box, reverse brainstorming, forced connection, effort-impact matrix* and action plan *Control:* Change management plan, stakeholder engagement strategies, force-field analysis and solution-effect analysis

Note: Italic text are CPS tools

Table 1.
Comparison of LSS and LIT

time: through training and supporting their creative role identities (Farmer *et al.*, 2003; Tierney and Farmer, 2011).

Action learning has proven to be effective in developing self-awareness about making a valuable contribution on the basis of past experiences, especially if people are motivated to

learn and to improve (Howell, 1994; Lee and Jang, 2014). Our action-learning-based LIT is designed in accordance with previous reports on developing CRI and IWB among work-floor employees (Ashforth and Schinoff, 2016; Chaubey *et al.*, 2022; Cusins, 1996; Scott *et al.*, 2004; Tierney and Farmer, 2011).

2.3 Transformational leadership affects creative role identity formation

Besides solid training, employee CRI and IWB are likely to be affected by work contexts (Amabile and Pratt, 2016), especially by their perceptions of leadership expectations (Scott and Bruce, 1994). If employees perceive that creativity and innovation are valued, as in the case with effective lean leaders (Van Dun and Wilderom, 2021), they will be more inclined to internalize these activities as part of their self-definition and engage in IWB (Maitlis, 2005). However, if employees anticipate a negative response, they will avoid IWB (Montani *et al.*, 2017) as this might entail a potential loss of self-belief in relation to a specific function (Karwowski and Kaufman, 2017; Xing *et al.*, 2021).

According to Seidel *et al.* (2019), improving employees' CRI and IWB, through LSS and CPS, can be done by transformational leaders. TFL is characterized by four leader behaviors: idealized influence, inspirational motivation, intellectual stimulation and individualized consideration (Bass, 1999; Jung *et al.*, 2003). Together, they inspire employees to accomplish collective goals. This emphasis on collective goals may make TFL especially impactful in public service organizations given their community-oriented nature (Bason, 2018; Tan *et al.*, 2021). TFL is known to support employees' self-identity, based on high self-reinforcement instead of external rewards (Tan *et al.*, 2021), thereby promoting experimentation and creative outcomes (Azim *et al.*, 2019; Paulsen *et al.*, 2013; Paulsen *et al.*, 2009). Indeed, Hirst *et al.* (2009) found that inspirational motivation from a leader can boost positive identification and creative effort; transformational supervisors can thus influence employees' identities positively (Paulsen *et al.* (2009).

Following the *social learning theory* (Bandura, 1997), one may think of transformational leaders as strengthening followers' CRI as well as their interest in adopting LSS and CPS tools. This theory posits namely that leader and employee behaviors may be linked, given that people are inclined to learn from successful superiors with such a style (Azim *et al.*, 2019). It is expected that TFL has a positive effect on employee CRI formation, based on Bandura (1997) four efficacy judgment sources: observational learning, verbal persuasion, enactive mastery and physiological arousal.

Observational learning can help employees become more confident in their ability to develop new ideas (Dvir *et al.*, 2002), whereupon role modeling by a transformational leader can enable employees to stay curious and reframe problems (Jung *et al.*, 2008). Tan *et al.* (2021) found inspirational motivation by leaders, including clear expectations about the importance of innovation, bolstered employee confidence in innovative work: a sign of *verbal persuasion*. Through a combination of intellectual stimulation (e.g. encouraging novel approaches) and charismatic leadership behaviors (including contagious communication and compelling visions) (Paulsen *et al.*, 2009), transformational leaders enhance employee independence and critical thinking (Dvir *et al.*, 2002). Employees are, therefore, more likely to view themselves as capable of innovation. Also, efficacy can be maintained by facilitating training, coaching and feedback, aimed at improving employees' competence in the adoption of LSS and CPS. Thus, the employees will conceivably have successful *enactment mastery* experiences (Vera and Crossan, 2004), which, in turn, could increase their CRI and IWB over time. Vera and Crossan (2004) also argued that a transformational leader stimulates feed-forward learning, experimentation and risk-taking by individual followers. Through individualized consideration, transformational leaders show empathy, appreciation,

consideration and support for employees who tackle issues proactively (Azim *et al.*, 2019). This is important because some creative endeavors may be perceived as risky and challenging (Chaubey *et al.*, 2022; Jung *et al.*, 2008). Followers with transformational leaders are less likely to experience anxiety or aversive *physiological arousal*, which would decrease their CRI and, thus IWB (Yokozawa *et al.*, 2021). Additionally, there is some evidence that the behavioral effects of TFL, mostly attributed to line managers, can also be induced by people outside an organization with similar employee-encouraging and coaching type behaviors, such as external trainers and coaches (Gumusluoğlu and Ilsev, 2009).

3. Methods

3.1 Research setting

The study took place in a small-sized public service organization in Singapore with 54 permanent staff at the onset, spread over three departments. Each department was led by a head of department who reported to the Chief Executive; the departments consisted of multiple sections that were managed by section managers. The agency organized social engagement programs to promote cross-cultural collaboration, whereby employees were expected to constantly think of new ways to engage individuals and communities with similar interests. However, the Chief Executive did not see any tangible and innovative contributions in terms of realized process improvements despite considerable investments in staff training, including in creativity skills or design thinking. The Chief Executive was also concerned that some of the employees were holding back in giving ideas and did not challenge previously held assumptions when carrying out their work. She was fully aware that her directive leadership style might not be the best way for her to motivate employees to embrace innovation since such style is typically associated with reduced followers' freedom in many areas, including creative self-expression. Therefore, she contacted the researchers to deploy a baseline survey and then a customized action-learning type of training to enhance employees' CRI and IWB, including an assessment of its longitudinal effects. The Chief Executive also admitted that she and her heads of departments may have focused too much on the intended change rather than on the development of organizational learning capabilities. She, thus, expressed her full commitment to this capability development process by participating, i.e. role modeling to her employees and in championing the agency's core values: daily work excellence, collaboration and people-centeredness. One of the authors (a certified LSS black belt) was asked to design and implement the LIT, together with a master black belt. Both were part of a local business advisory and training firm specialized in LSS, innovation and organizational development.

3.2 Research design

This study applied a longitudinal action-learning intervention analysis using a mixed methods approach to investigate both quantitatively and qualitatively the effects of a LIT that incorporated action-learning methodology. After identifying and scoping the objective of the study with the case organization's Chief Executive, we conducted a survey at Time 1 (T1) among all the employees to understand the baseline of their CRI and IWB and their perceptions of the senior management leadership style, i.e. the agency's chief executive and her three head of department (HOD)s. We also held two focus group interviews at T1, one with the managers and the other with the nonmanagerial staff, to corroborate the survey's findings (Czarniawska, 2007). Upon reviewing the T1 survey and interview findings with the Chief Executive and her heads of departments, we designed and implemented LIT as a five-day training intervention, which occurred at T2, combined with project execution and frequent project team coaching. We assessed the effect of the intervention through water

cooler conversations and observations at T1, T2 and T3, as well as a second survey among all the employees together with two focus group interviews at T3. We reviewed the postintervention findings with the Chief Executive and her heads of departments. The LIT design and data collection methods are depicted in Figure 1.

When designing the longitudinal study of the training effects, we noted a wide disparity in the literature in the duration of the data collection intervals, ranging from two months (Choi, 2004) to 18 months (Axtell *et al.*, 2006). The literature on socialization driving behavioral change offered specific guidance (Ashforth *et al.*, 2007). Following Bauer *et al.* (2007), Pearce and Ensley (2004), Tay *et al.* (2006) and Van Dyne *et al.* (2002), we collected data from the employees at three points in time, spanning 11 months with a six-month lag between the last workshop (Control) and T3.

3.3 The intervention: Lean innovation training through action learning

The five-day LIT (see Appendix 1 and Figure 1) was structured using LSS's DMAIC phases and the action-learning methodology, aided by a set of carefully selected tools from LSS (Atmaca and Girenes, 2013; Kaufmann, 2012) and CPS (Proctor, 1999). The action-learning approach followed Kramer (2007) by focusing on:

- real problems that are important, critical and complex;
- diverse cross-functional problem-solving teams;
- curiosity, inquiry and reflection;
- converting talk into action and effective solutions; and
- participants committed to learning.

The training was delivered by the master black belt and his colleague: the first author.

During the first LIT day, a business simulation mimicked two fictitious courier companies that were competing for a business deal from a customer; all the organizational members were assigned roles in both companies and at the customer organization. In stages, the participants progressed through the simulation, moving from defining the problem via measuring performance, analyzing the root-causes of the problem, defining their business

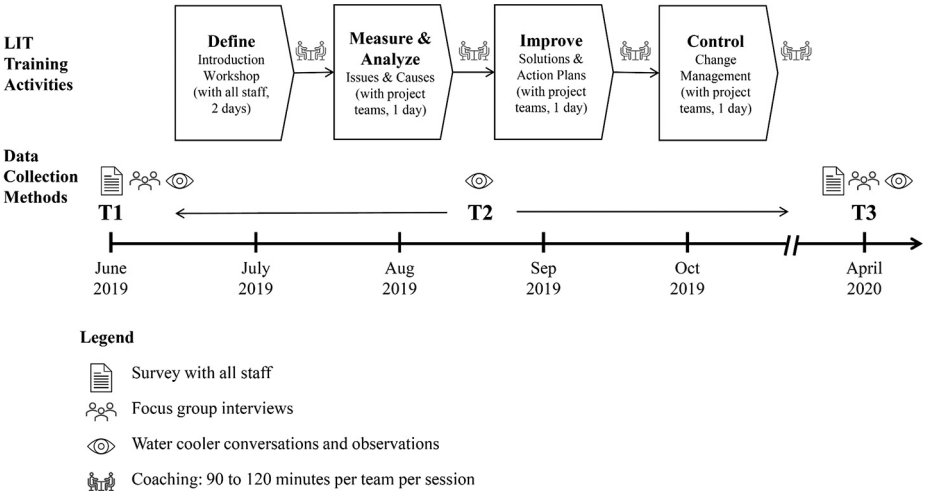

Figure 1.
LIT design and data collection methods

model and identifying their value proposition, to designing implementable solutions. The simulation enabled the participants to learn and apply the offered LSS and CPS tools first-hand in a safe experimental space, driving home the key message: that every one of them could be creative.

The first two consecutive days of the LIT were conducted with all the staff, including senior management. After an incubation period of four weeks, three training days with a four-week interval between each (see Appendix 1 and Figure 1) were aimed at the nonmanagerial staff. After each of these days, the master black belt supported the three newly formed project teams through face-to-face coaching sessions of 90–120 min per team. These project teams consisted of four to six cross-functional members who were selected by the senior management. Each project had a head of department as a sponsor, and a section manager as a project leader. One project's aim was sustaining the innovation in the organization (dubbed the "Innovation Culture Team"). The other two projects had to reduce the turnaround time for two customer-related processes. All the projects were scoped and defined during day two of the Introduction workshop (see Appendix 1), following the methods taught on day one. The subsequent three training days with the project teams started with a short project milestone check by the sponsors, who also offered advice. Subsequently, new tools were introduced by the master black belt and applied by the project teams to the three projects. In between those training days, the master black belt provided coaching and feedback to the project teams. Before starting the Measure and Analyze day (see Appendix 1), one employee was added to each project team because of recent hiring.

3.4 Sampling and sample description

Surveys were distributed among all the employees before and after the intervention. We included all the employees since they can judge their direct supervisor's leadership style and their own CRI best, and they are the carriers of IWBs. We decided to send the survey to all the employees to curb any sampling-related issues. The response rate at T1 was 100% (N = 54, M_{age} = 36.54 years old; $M_{OrgTenure}$ = 3.11 years). The response rate at T3 was also 100% (N = 62, M_{age} = 36.23 years old; $M_{OrgTenure}$ = 3.21 years).

In terms of the focus groups, the participants were divided into managers and nonmanagerial staff. The group of managers comprised three male HODs and three section managers, of which two were female. The nonmanagerial group consisted of seven employees (three were male) who ranged in age from 29 to 63. These employees were nominated by their HODs and section managers following the criteria that these employees had worked in the agency for more than one year; were familiar with own and other functional areas; and were likely to speak up, including those who seemed to be skeptical about innovation practice but were prepared to contribute their views during the focus-group discussion. By also asking HODs to nominate more skeptical staff, enabled us to gather a balanced view and to avoid bias, which was also apparent from their honest responses.

3.5 Data collection

3.5.1 Pre- and postintervention survey. The pre- and postintervention survey (see Appendix 2) comprised three validated scales based on a seven-point Likert scale ranging from strongly disagree (1) to strongly agree (7) unless indicated otherwise:

Creative role identity. We used an adapted version of Farmer *et al.*'s (2003) CRI scale to measure the extent to which employees view creativity as a central aspect of self-identity. The scale consisted of three items; a sample item is: "To be a creative employee is an

important part of my identity." The Cronbach's alpha's were satisfactory: T1 $\alpha = 0.80$; T3 $\alpha = 0.86$.

Innovative work behavior. We measured IWB with nine items (Janssen, 2000). An example item is: "I search out new working methods, techniques or instruments." In this study, the self-reported measure was appropriate because employees have the most accurate information about how innovatively they perform their tasks (Axtell *et al.*, 2006). The Cronbach's alpha's were satisfactory: T1 $\alpha = 0.80$; T3 $\alpha = 0.82$.

Transformational leadership was measured on a seven-point Likert scale ranging from never (1) to always (7), by capturing the employees' perceptions about their direct supervisors' idealized influence (eight items), inspirational motivation (four items), intellectual stimulation (four items) and individualized consideration (four items), using the 20-item Multifactor Leadership Questionnaire Form 5X (Bass, 1997), licensed by Mindgarden. An example item is "My manager gets me to look at problems from many different angles." The Cronbach's alpha's were good: T1 $\alpha = 0.86$; T3 $\alpha = 0.89$.

3.5.2 Interviews. To interpret the survey findings better, additional data were collected via focus group interviews (Onwuegbuzie *et al.*, 2009) with the same participants: two at T1 and two at T3. The managers and employees were interviewed separately on different days to avoid any bias by assuring a psychologically safe environment to speak up (Vaughn *et al.*, 1996). The interviews were led by the master black belt and assisted by one of the researchers (Dilshad and Latif, 2013). All the participants had been informed in advance of the purpose of the interviews and knew their data would be treated anonymously; they agreed to being audio-recorded.

The interview questions, which were based on our literature review (Corbin and Strauss, 2014), were constructed in parallel to developing the survey, the intention being to deepen our insights into the respondents' views on CRI, IWB and TFL in their organization. Appendix 3 presents the interview questions used in both the employee and manager focus groups. The first part of the questions to the employee focus group explored their perceptions of "own role identity for innovation"; for example: *What does innovation mean to you in your daily work?* This broad question enabled us to find out whether the employees thought about innovation and whether being innovative was going to be an important part of their identity at work (Farmer *et al.*, 2003). Then, to understand their needs better (Prieto and Pérez-Santana, 2014; Suseno *et al.*, 2020), we asked: *Do you feel you have the knowledge and skills to innovate at work?* The subsequent questions explored the perceived leadership support for being innovative (Amabile *et al.*, 2004; Tan *et al.*, 2021). For example: *When was the last time you sought a new idea to solve a problem or to introduce change at work? How did your manager react to your contribution? What did your manager say? What about your colleague(s), what was their reaction? What did they say?* These questions allowed us to find out if and how their managers applied TFL, for instance, by showing empathy, appreciation, consideration and support for them to tackle issues proactively during the creative process (Azim *et al.*, 2019). The last question was aimed at their preferences: *What kind of support do you need more of?*

We followed that same aforementioned procedure to construct the interview questions for the managers. Our aim was to understand their views on innovation better, their role in enabling it, as well as other factors they saw as determining the employees' CRI and IWBs. Example questions were: *When was the last time you encouraged your employees to solve a problem by being innovative? How did you do it? What was the outcome? How did your employees react to it? What behaviors would you like your staff to show more of?*

To mitigate researcher bias further, we triangulated the interview results by collecting data through observations and water cooler conversations throughout the entire study

(Newton *et al.*, 2019). All the interviews were conducted by both trainers, whereas the water cooler conversation notes were only taken by the master black belt at T1, T2 and T3.

3.5.3 Data analysis. To obtain an indication of the relationship between TFL on the one hand and CRI and IWB on the other hand, we conducted a correlation analysis between these factors as well as between T1 and T3 (see Table 2).

Next, to evaluate the inter-rater agreement among the employees about the level of TFL, CRI and IWB at T1 and T3, we looked at the consistency of the employees' survey ratings. Both at T1 and T3, we calculated the intraclass correlation coefficients (ICCs) of CRI, IWB and TFL (see Table 2). The ICCs of the three variables were within and, in one case above, the moderate and strong agreement range level, 0.51 to 0.90 (LeBreton and Senter, 2008). These findings indicated that there was considerable agreement between the employees.

Two-sample *t*-tests were applied to explore the differences in terms of CRI, IWB and TFL between T1 and T3, further expounded by the qualitative data from the interviews. To get the data, the focus group interviews and the informal chats at the water cooler were transcribed and coded using Gioia's inductive approach (Gioia *et al.*, 2013; Locke *et al.*, 2020) by first coding the more abstract (informant-centric) terms and then seeking for similarities and differences among the many categories: to cluster and link them to the theory-based concepts of interest (Glaser and Strauss, 2017): TFL, CRI and IWB. Using the resulting codebook, the two trainers coded all the interviews line by line, and then discussed the coding and labels with the second author to avoid misinterpretations and confirmation bias.

4. Results

4.1 Pre- and postintervention comparisons of quantitative data

We will first report the exploratory pre- and postintervention survey results. Table 2 shows the zero-order correlations among the variables; the correlations between the same T1 and T3 variables were mostly nonsignificant. At T1, the correlation between TFL and CRI was significant, while at T3, this correlation had become nonsignificant. However, TFL and IWB were significantly correlated at both times.

Table 3 shows the two-sample *t*-test results of the variables at T1 and T3. The level of CRI ($t = 4.920$, $p = 0.0000$) as well as IWB ($t = 4.263$, $p = 0.0001$) was significantly higher at T3 compared to T1. Additionally, except for inspirational motivation ($t = 1.155$, $p = 0.2511$), the overall TFL along with three of the four TFL dimensions had increased significantly at T3: idealized influence ($t = 2.545$, $p = 0.0129$), intellectual stimulation ($t = 3.060$, $p = 0.0031$) and individualized consideration ($t = 2.953$, $p = 0.0042$).

The data obtained through the interviews at T1 and T3, plus the observations at T2, will be used to enrich our understanding of the relationships between the variables, including how TFL and CRI enhance IWB.

4.2 Preintervention level of creative role identity

The interviews and water cooler conversations with managers and employees before the intervention led to identifying several CRI, IWB and TFL related themes (see Table 4).

Both the managers and employees seemed to agree that the managers did not communicate (sufficiently) the need for innovation in their organization; they also did not appear interested in it. An employee illustrated: "We want to do our best but at times our leaders do not seem to show interest in what we are doing" (Table 4). Another employee illustrated the low level of TFL at T1: "Talking is cheap - just issuing a memo to ask everyone to think of ways to improve our daily work won't do" (Table 4). In addition, the staff, including the managers, did not see themselves as being creative, a sign of low CRI: "I am not creative. I am not sure I can really help" (Table 4). They were also skeptical since they were part of a government entity "that does

Nr.	Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1	T1-CRI	5.15	1.25													
2	T1-IWB	4.56	1.19	0.62***												
3	T1-TFL	5.04	1.22	0.45***	0.74***											
4	T1-TFLii	5.19	1.28	0.44***	0.70***	0.96***										
5	T1-TFLim	4.95	1.30	0.45***	0.71***	0.96***	0.89***									
6	T1-TFLis	5.04	1.22	0.34*	0.67***	0.93***	0.83***	0.88***								
7	T1-TFLic	4.85	1.32	0.44***	0.71***	0.92***	0.81***	0.86***	0.83***							
8	T3-CRI	6.07	0.62	0.48***	0.36**	0.19	0.19	0.22	0.07	0.20						
9	T3-IWB	5.34	0.66	0.05	0.03	0.16	0.11	0.13	0.13	0.25	0.28*					
10	T3-TFL	5.52	0.60	0.19	0.27	0.25	0.25	0.23	0.14	0.30*	0.14	0.52***				
11	T3-TFLii	5.68	0.68	0.29*	0.26	0.19	0.19	0.19	0.05	0.25	0.14	0.34*	0.89***			
12	T3-TFLim	5.19	0.91	0.24	0.36**	0.31*	0.28*	0.33*	0.22	0.35*	0.26	0.48***	0.78***	0.57***		
13	T3-TFLis	5.60	0.60	0.00	0.10	0.12	0.12	0.07	0.10	0.16	0.06	0.57***	0.79***	0.55***	0.55***	
14	T3-TFLic	5.44	0.70	−0.07	0.07	0.16	0.18	0.12	0.10	0.19	−0.08	0.40**	0.77***	0.62***	0.37**	0.67***

Notes: CRI: creative role identity; IWB: innovative work behavior; TFL: transformational leadership; TFLii: idealized influence; TFLim: inspirational motivation; TFLis: intellectual stimulation; TFLic: individualized consideration; T1 $n = 54$; T3 $n = 62$; *$p \leq 0.05$; **$p \leq 0.01$; and ***$p \leq 0.001$

Table 2.
Pearson's zero-order correlations

not need creativity" (Table 4). An employee commented at T1 that he did not consider innovation to be more important than getting the work done given that he was already overwhelmed with his daily tasks, which is related to the low level of CRI. Similarly, a manager commented that his staff often came to him for ideas even though he had been encouraging them to try on their own, "they do not see the need to do so. They prefer to stick to the old ways" (Table 4). Nonetheless, they did express curiosity and openness to learn because it generally "cannot be bad to learn new skills" (Table 2). In addition, the employees called for their managers to be involved and trained "in these processes and the importance of leadership" (Table 4). So, according to the T1 survey findings (see Table 3), there was a low level of CRI and IWB prior to the intervention among most of the employees as well as a relatively low level of TFL.

These observations influenced the design of the training intervention to overcome the low CRI by letting all the employees and managers participate in CPS exercises; to raise confidence among all the employees to engage in innovative, productivity-increasing behaviors in their own work contexts; to familiarize all the employees and managers with the LSS and CPS tools; and to stimulate TFL among the managers.

4.3 Embracing creative role identity and innovative work behavior

At the end of T2's two-day Introduction workshop, we noticed the managers' and employees' confidence levels had changed. Since the business simulation exercise was fun for all, and the LSS and CPS tools were introduced in between the simulation rounds, the participants were in a good mood directly after the introduction workshop. During the check-out conversation, the employees produced comments like "I am surprised that I can be creative", and "I feel more confident now to speak up and challenge my own and my colleagues' processes" and "The tools help a lot. I love SCAMPER" (Table 4). These remarks show that they were overcoming their self-view of not being creative, i.e. developing their CRI. Moreover, they could see the benefits of using a structured improvement roadmap, like DMAIC, that puts the focus on customer requirements, data-driven improvement decisions and value-added flow analysis, before seeking creative solutions for identified root causes. Hence, most of the employees recognized the power of questioning their own work processes and finding new ways to add value to their customers, i.e. an apparent shift in employees' CRI and motivation for innovation. Of course, there were also some who noted that innovation works in a "perfect training environment" but that it cannot be easily applied to "my work processes" (Table 2). To tackle these doubts, the subsequent application of the learned LSS and CPS tools to their own work processes was critical.

Table 3.
Two-sample *t*-test results and ICCs of the study's variables at T1 and T3

Variables	T1 ($N = 54$) Mean	T1 ($N = 54$) SD	T3 ($N = 62$) Mean	T3 ($N = 62$) SD	*t*	T1 ICC	T3 ICC
Creative-role identity (CRI)	5.15	1.25	6.07	0.62	4.920^{***}	0.84	0.98
Innovative work behavior (IWB)	4.56	1.19	5.34	0.66	4.263^{***}	0.86	0.72
Transformational leadership (TFL)	5.04	1.22	5.52	0.60	2.617^{*}	0.82	0.82
TFL – Idealized influence (TFLii)	5.19	1.28	5.68	0.68	2.545^{*}	0.88	0.85
TFL – Inspirational motivation (TFLim)	4.95	1.30	5.19	0.91	1.155	0.78	0.62
TFL – Intellectual stimulation (TFLis)	5.04	1.22	5.60	0.60	3.060^{**}	0.68	0.69
TFL – Individualized consideration (TFLic)	4.85	1.32	5.44	0.70	2.953^{**}	0.77	0.71

Notes: $^{*}p \leq 0.05$; $^{**}p \leq 0.01$; and $^{***}p \leq 0.001$

Table 4. Data structure of managers' and employees' verbatim comments at T1, T2 and T3

Verbatim comments	First-order code	Second-order theme	Aggregated dimension
"We want to do our best but at times our leaders do not appear to be interested in what we are doing. Sometimes I feel like a headless chicken." (Emp at T1)	Show interest	Inspirational motivation	Transformational leadership
"I could feel the entire organization is involved after the 2-day LIT introduction workshop. We focus on addressing the issues rather than pointing fingers and blaming each other. We now have a collective thinking spirit." (Emp at T2)			
"I encourage my staff to innovate and make changes, but they will not 'move' unless I record it in their performance plans." (Mgr at T1)	Sense of purpose		
"I like the way my manager applies what we have learnt during the LIT, especially in scoping the issue and providing direction on how I should tackle the issue." (Emp at T2)			
"I think they (managers) should be informed about these processes and the importance of leadership. This is my opinion because many are very unsure about providing a vision in their job." (Emp at T1)	Provide vision	Idealized influence	
"I could see that management has become more understanding and encouraging. They make things happen; it is no longer like in the past when they just paid lip service." (Emp at T3)	Make things happen		
"Talking is cheap - just issuing a memo to ask everyone to think of ways to improve our daily work won't do." (Emp at T1)	Communication	Individualized consideration	
"This way, we as leaders keep our employees motivated, and show that we care and value their views." (Mgr at T2)	Listening		
"It was only through the training and our project that we got to come together with colleagues from different departments to question and challenge each other's work processes. And our sponsor [Manager] is aligned. He makes time to listen, gives feedback and even works with us in resolving the issues. I feel more confident now to speak up and challenge my own and my colleagues' processes." (Emp at T2)	Make time		
"During this period of working with the team on their projects, two-way communication and timely feedback are really essential. This keeps our employees motivated and shows that we care and value their views." (Mgr at T3)	Feedback		

(*continued*)

Table 4.

Verbatim comments	First-order code	Second-order theme	Aggregated dimension
"I have learnt to hold quality conversations with the staff. This helps to build the foundation of our relationship. I could sense that the employees feel more comfortable with me joining them in their monthly Time for Innovation session." (Mgr at T3)	Coaching		
"I have started having dialogues with employees at various levels. Through these sessions, I get to know the employees better, and get to hear their thoughts and ideas for improving our operations and the community." (Mgr at T3)	Relationship building		
"Some of the tasks I am handling are simple, but they are just administratively complex due to the nature of our work. I have suggested to my boss to change the way we work. I hope it can happen soon." (Emp at T1)	Initiate change	Intellectual stimulation	
"My manager has started a monthly 'time for innovation' session for us to look at our work processes and explore ways to improve. I really like this." (Emp at T3)			
"I often encourage my staff to give ideas, even if they may sound silly. However, they do not see the need to do so. They prefer to stick to the old ways." (Mgr at T1)	Challenge status quo		
"I am not creative. I am not sure I can really help. It cannot be so bad to learn a new skill though." (Emp at T1)	Being creative	Confidence to innovate	Employee creative role identity
"I have difficulty in expressing my thoughts and work improvement ideas to my staff." (Mgr at T1)			
"I am not aware that innovation can be applied on our daily work. This makes a lot of sense." (Emp at T2)			
"Creativity is needed at Apple. We are a government entity. How creative are we allowed to be?" (Emp at T1)	Skepticism		
"If everyone is expected to give ideas at work, who is going to get things done." (Emp at T1)			
"I do not think innovation is more important than getting our work done. I am already pretty swamped with my work." (Emp at T1)			
"Innovation works in a perfect training environment but not in my real work processes." (Emp at T2)			
"I told you, this does not work in real life." (Emp at T2)			

(*continued*)

Table 4.

Verbatim comments	First-order code	Second-order theme	Aggregated dimension
"Creativity is not too difficult. The tools help a lot. I love SCAMPER." (Emp at T2)	Ease		
"This was fun. And we created some nice moments of surprise. My surprise is: this can really work." (Emp at T2)	This can work		
"The staff are not speaking up their ideas unless they know it will not come across as sabotaging their colleagues." (Mgr at T1)	Relationship with colleagues		
"When my colleague broke the silence and shared her ideas, especially during the project discussion and coaching, it made me feel confident and motivated to speak up, express my ideas too even though I knew they may not be perfect." (Emp at T3)	Self-confidence		
"I think what is important is to have a certain scope for autonomy, to offer freedom - freedom in one's own thinking." (Mgr at T1)	Freedom to think	Show individual creativity	
"I do not have the knowledge and skills to innovate." (Emp at T1)	Creativity	Idea generation	Employee innovative work behavior
"My staff is not creative. They often refer to me for ideas." (Mgr at T1)			
"I am surprised that I can be creative." (Emp at T2)			
"I am happy with what my predecessors have set up, there is no need to change." (Emp at T1)	Challenge status quo		
"I could see that there are many processes we really need to improve. Otherwise, we will not progress as an organization." (Emp at T2)			
"We have made some major amendments in our processes. Now we need to make sure management approves and we make it stick." (Emp at T2)	Get approval	Champion ideas	
"Did you see our innovation dashboard in the pantry? This is the result of our project work." (Emp at T3)	Result		
"After we went through the introduction workshop, we were convinced that coming together with managers and colleagues in co-creating improvement ideas could work for us. I am glad that we delivered our project with some creative ideas and concrete results." (Emp at T3)	Cocreation	Brainstorming	
"I have already applied reverse brainstorming in team meetings. It really helps." (Emp at T3)	LIT tool application		

Notes: Emp: nonmanagerial employee; Mgr: Manager

It did help that the agency's Chief Executive and heads of departments did *not* play management roles in the simulated company during the introduction workshop. All the agency's staff could see them actively participating in innovating their jobs as clerks, and reporting to the people they normally led. This showcased a high degree of trust between the managers and their followers that was not obvious at T1, given the traditional hierarchy in this public service organization. Learning through an experiential activity seemed to contribute to a change in the participants' mindsets. During the subsequent LIT days, most of the employees were motivated to apply what they had learnt and make use of the "sexy new tools", like reverse brainstorming. Yet, during the improvement project, some employees remarked "I told you, this does not work in real life" (Table 4) whenever something did not work as smoothly as during the first day. Thus, the project coaching by the master black belt in between the three LIT days had to break through this skepticism and improve the employees' CRI.

The project teams' monthly milestone checks with the sponsoring HODs ensured that:

- senior management could learn about the progress made, show support for and continue to role-model innovation *vis-à-vis* the teams;
- possible solutions could be tested together with senior management without delay; and
- problems could be solved quickly.

An employee noted at T2: "We have made some major amendments in our processes. Now we need to make sure management approves and we make it stick" (Table 4). In addition to this example of IWB, the employees showed more confidence to innovate. Senior management's feedback and involvement were critical throughout the LIT; over time, the sponsoring HODs gradually started supporting the external trainer more when he was engaged in project coaching. An employee remarked, "And, our sponsor [manager] is aligned. He makes time to listen, gives feedback and even works with us in resolving the issues" (Table 4). A manager explained at T2: "This way, we as managers keep our employees motivated" (Table 4).

Similarly, the employees noticed the positive effects of senior management's change toward a more TFL style; they pointed especially at the regular feedback and two-way communication they were having with their managers since starting the LIT. One employee illustrated:

> "He makes time to listen to us, gives us feedback and even works with us in resolving the issues. I feel more confident now to speak up and challenge my own and my colleagues' processes" (Table 4).

Another employee shared during the project coaching session, "I like the way my manager applies what we have learnt during the LIT, especially in scoping the issue and providing direction on how I should tackle the issue" (Table 4). At T3, the Chief Executive shared:

> "I have started having dialogues with employees at various levels. Through these sessions, I get to know the employees better, and get to hear their thoughts and ideas for improving our operations and the community" (Table 4).

This support from management for their collaborative projects with employees had positive effects; one employee shared excitedly, already at T2, "We focus on addressing the issues rather than pointing fingers and blaming each other. We now have a collective thinking spirit" (Table 4).

Toward the end of the improvement projects, service turnaround time had been reduced by at least 38% for those measures with an available baseline. Moreover, the Innovation Culture project-team leader proudly directed the trainers to their pantry wall that was covered with a huge colorful whiteboard (headlined "Innovate"). Not only had they implemented one of their solutions, but they had also generated many useful ideas on this wall.

4.4 Sustaining the change

Over the course of supporting the project teams at T2, we noticed a shift in senior management's leadership style: from directing and instructing employees to affiliating, consulting and participating in problem-solving. For example, one head of department reflected after the intervention (at T3):

> "I have learnt to hold quality conversations with employees (. . .). I could sense that the employees feel more comfortable with me joining them in their monthly 'Time for Innovation' session."

Likewise, one of this manager's staff members noted: "I could see that management has become more understanding and encouraging" (Table 4). Such increase in TFL among the managers, which was also apparent from the survey findings (Table 3), was clearly a result of them participating in the training and work on the projects with their employees. This employee added, "They [managers] make things happen; it is no longer like in the past when they just paid lip service" (Table 4). Additionally, at T3, many employees recognized the benefit of the LIT tools in their daily work processes: "I have already applied reverse brainstorming in team meetings. It really helps" (Table 2). Another employee shared at T3 that she felt more confident to contribute her ideas during meetings and discussions, "(. . .) it made me feel confident and motivated to speak up, express my ideas too even though I knew they may not be perfect." (Table 4). Also, according to another employee at T3, his head of department set aside time for everyone to review their work processes and to apply LIT tools, "My manager has started a monthly 'time for innovation' session for us to look at our work processes and explore ways to improve. I really like this" (Table 4). Altogether, these quotes show that more employees felt motivated and safe to innovate, i.e. the change in TFL seemed to have contributed to a higher level of employee CRI and IWB.

Already three months after T3, both senior management and employees noted during one of the visits by the trainers that the culture had shifted. Signs of innovation were clearly visible; the abovementioned innovation wall in the pantry still showed the ideas, and their up-to-date implementation status. After first working on their own innovating internal processes, they took the innovations to their local partner organizations to also help them reinvent their ways of working. The organization was recognized for its innovation journey by the Singapore government with an Innovation Excellence Award.

5. Discussion

This longitudinal, mixed-methods study investigated the effects of a LIT intervention, which combined LSS and CPS tools, in a public service organization. The action-learning approach of the LIT contributed to a significant improvement in employee CRI and IWB. Through the intervention, all the public service agency's employees learnt together (including all the managers during the first two days). Moreover, the staff set aside any beliefs that they could not be creative and started to apply *both* the LSS and CPS tools to come up with ideas to address organizational issues. Our positive results are consistent with prior research on action learning by Lee and Jang (2014). At the same time, one additional enabling factor became significantly elevated over time: senior management's TFL style.

Thus, the results extend the literature on requirements for successful LSS and CPS (training) applications, especially in the public sector. They reemphasize the importance of involving employees in setting up and implementing innovation initiatives, leading to the integration of knowledge across the organization (Bysted and Jespersen, 2014; Rodgers and Antony, 2019). The results, therefore, respond to Lameijer *et al.*'s (2021) recommendations to restructure the traditional LSS training program, in this case by integrating CPS tools, to fit more disruptive innovation types of organizational settings like, in this case, the Singaporean public service sector. These findings have the following theoretical implications:

First, in line with the role *identity theory*, trainings that aim to advance LSS and CPS in an organization can boost employees' CRI when an allowance is made for managers and coworkers to actively experience being creative, but it helps if they listen to each other's innovative ideas. The structured team-based approach, which is common in LSS improvement projects, provides an unbiased framework in which ideas can be assessed, evaluated and selected for progression. When employees notice that their improvement initiatives make a measurable impact, they will feel more confident to make bigger, perhaps more risky contributions in the future. Our findings confirm that not only the initial two LIT days but also the work on the three projects, contributed to the significantly higher staff CRI and IWB scores and senior management's increased TFL. Such combinations of experiences help to instill a positive CRI (Farmer *et al.*, 2003) among the employees who can act as agents for LSS project success in the short term, which can then bring about a cultural transformation in their organization (Alblooshi *et al.*, 2020; Rodgers and Antony, 2019). Additionally, the *social identity theory* states that if a group embraces and values creativity, and members identify with that group, this not only affects behavior but also one's self-definition, in this case: one's CRI (Van Knippenberg *et al.*, 2013) and IWB. Hence, when individuals are enabled to modify their social relations through a shared learning and action-based experience, they can reinforce each other's IWB and work more creatively together. Such extant group memberships can lead to psychological safety, which may increase an individual's potential for innovation (Fenner *et al.*, in press; Hülsheger *et al.*, 2009; Van Dun and Wilderom, 2012), and thus, CRI. Stimulated by the introductory workshop, the studied project teams actually developed an innovative mindset, which enabled the entire LIT to have an impact. This is promising, given that many public-sector employees across the globe still face work cultures of control instead of trust and learning (Moussa *et al.*, 2018).

Second, our findings show that even if the norm to be more innovative was not widely shared or actively voiced before by leaders, employee behavior can be shaped by a short social learning or training process in which their leaders adapt such behaviors in authentic ways (Bandura, 1997). The results extend the LSS and CPS training literature by illustrating the importance of coactive vicarious learning (Myers, 2018; Van Dun and Wilderom, 2021; Zhong *et al.*, 2021); on day 1 of the LIT, all the senior management members role-modeled IWB which – together with their supportive behavior during the rest of the LIT – increased the employees' CRI and IWB. Coactive vicarious learning-by doing is defined as an active and "a relational process of co-constructed, interpersonal learning that occurs through discursive interactions between individuals at work" (Myers, 2018, p. 610). Studies by Zhong *et al.* (2021) and Van Dun and Wilderom (2021) found that supervisory coactive vicarious learning provides the premise for creating an organizational climate of innovation and high lean team performance. Thus, the effects of managers' coactive vicarious learning in LIT type training interventions on staff CRI and IWB warrants further research in relation to creating more innovative (public-)service organizations.

Third, as expected from the literature, the *TFL style* can accelerate the effects of LIT training as it prompts employees' vision and enthusiasm to engage in double-looped adaptive learning (Kolb, 2014) by experimenting and encouraging others to do the same (Bass, 1999). Our study shows that leaders who behave in a transformational way are more likely to increase their employees' CRI and IWB by voicing their constructive critiques (Tan *et al.*, 2021; Wang *et al.*, 2014). The simulation on the first day of the LIT training enhanced the managers' and employees' awareness of their potential roles and ability in innovating the agency's daily work, as they had experimented with their IWB in a safe (simulated) space. This awareness accelerated the managers' display of TFL by role-modeling innovation throughout (and after) the LIT. Thus, a LIT that integrates LSS and CPS tools as well as various experiential activities, *coupled* with TFL, induces employees' CRI for producing many innovative solutions. The real-life project work after the cognitive learning spurred the managers to take up responsibility, enhancing TFL as a catalyst for staff IWB. The LIT, thus enabled reciprocal feedback loops and coactive vicarious learning between the senior managers and their staff, as well as among the staff. This finding is in line with Seidel *et al.* (2019) that TFL can be a potent leadership style when implementing lean. We observed that TFL can be beneficial for public-sector organizations as it reduces a dependency on superiors for ongoing decision-making, directives and daily work management. Similarly, our study echoes Park *et al.* (2014) regarding the influencing mechanism of TFL in boosting and sustaining employees' IWB. Hence, we show the combined role of role identity, social identity and TFL theory in advancing what is known about effective LSS and CPS training, and the ways through which they lead to employees' (pro)active contributions to product/service/process innovation.

6. Managerial implications

Increasingly, public-sector employees need to cope creatively with the changing needs of citizens and other stakeholders they serve (Bason, 2018). The present study carves out three implications for senior public managers. First, the five-day action-learning-based LIT – that integrates both LSS and CPS tools as well as project coaching – may be a practical framework to raise nonmanagerial employees' CRI in such agencies. The LIT reported herein had been deployed before in eight publics, and even private-sector, Asian organizations. Since the participating agency's core values were rather generic LIT can probably be successfully applied in similar organizations across the globe, offering training in important employee skills for innovating organizational products, services and processes. In particular, (external/internal) coaches and consultants can offer this (or a similarly effective) action-learning type intervention to enhance employees' IWB by creating a workplace that fosters an organizational learning culture. Such LIT can be an enabler as it promotes activity-based learning through project management and structured problem-solving.

Second, transformational leaders can enhance employees' CRI, and ultimately boost their IWBs, through frequent role-modeling, active listening and timely provision of feedback. Organizations may consider enhancing the TFL style of their managers by exposing them to LIT, as shown in our study, although larger organizations compared to the one studied here may need additional interventions for some leaders to develop their TFL.

Third, the short duration type of LIT worked well in this organization and might have resulted in higher acceptance than with a more extensive traditional LSS training, and it delivered the expected outcomes. Such an arrangement is necessary given that in today's organizations, the pace of the changes and customer demands is soaring (Lameijer *et al.*, 2021).

7. Limitations and future research

Some of the current study's limitations offer research opportunities. First, future studies should consider including tangible (and not just perceptual, self-reported) measurements of the innovative results, like number of ideas generated, implemented and brought to fruition, as well as performance indicators like increased productivity. Such measures could also be communicated throughout the LIT to "keep the fire burning." Unfortunately, most of the measures were only introduced during the current project's intervention phase, meaning we did not have abundant "before data." In private-sector organizations, there is evidence that the presence of such concrete operational indicators, especially when crafted by the employees themselves, generates the creative effort among them to substantially improve their work (Wouters and Wilderom, 2008). Hence, the bottom-up facet of the LIT may coexplain the obtained results. Examining various other enablers of action-learning-based LIT, like the one described here, is needed as well. For instance, perhaps the external trainers role-modeled the new innovative work norms even more than the senior managers.

Second, this study emphasizes that the LIT's success was partly due to the senior managers' TFL style; the increase in employee CRI and IWB matched the increased scores for this style. Even though same-source bias may have played a role here, the qualitative data, including our own observations, corroborate this finding. To expand existing theories associated with the core factors examined here, future research must also examine the plausible mechanism of coactive vicarious learning on individual employee CRI enhancement in the context of LSS training interventions (Van Dun and Wilderom, 2021).

Third, we need to single out the relative effect of LSS *vis-à-vis* the CPS tools used, including the added value of the business simulation on day 1. The relative success of this LIT could partly be attributable to the high degree of shared innovation values among the involved senior management.

Fourth, this study is based on a single case study and, therefore, any generalizations to public-sector organizations elsewhere cannot be made. Hence, future research could consider deploying such LIT in both public and private sectors to gauge if employee CRI does act as an intermediate factor between employee training and IWB. Additionally, since the study was conducted in Singapore, which is at a mature state of innovation practices, means future studies should explore whether LIT has similar effects in countries with a less advanced state of innovation in the public sector.

Fifth, even though Gist (1989) study also resulted in positive effects after creative-problem-solving training (with a no-training control group), it is still possible that our improvements in CRI might have been due to the so-called Hawthorne effect. Thus, future studies of, ideally, much larger agencies should include a control group that receives the same training at a later stage.

Finally, we show this action-learning approach to LIT empowers public-sector employees to propose changes in their own work settings that are both creativity- and efficiency-enhancing. It would be fascinating to start charting the actions and learning effects over an even longer time frame so that the entire culture change setoff by the senior management and LIT training can be made more visible, showing even more convincingly that it is feasible and satisfying for all the stakeholders involved. The LIT training might have an accelerating effect on the adoption of LSS within public service organizations, and thus may prove its value for citizens, something future public-management research could explore further.

Notes

1. For seven consecutive years since 2014, Singapore has been ranked second in Asia-Pacific and eighth in the Global Innovation Index (2021).

2. SIPOC is an acronym that stands for Suppliers, Inputs, Process, Outputs and Customers. In process improvement, SIPOC is a tool that summarizes the inputs and outputs of one or more processes in a table form. It is used to define a business process from beginning to end.
3. SCAMPER is an acronym formed from the abbreviation of Substitute, Combine, Adapt, Modify (also magnify and minify), Put to another use, Eliminate and Reverse. SCAMPER is a lateral thinking technique which challenges the status quo and helps one to explore new possibilities.

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Table A1.
Lean Innovation Training outline

Workshop	Day 1: Introduction and innovation simulation	Day 2: Define	Day 3: Measure and analyze	Day 4: Improve	Day 5: Control
Participants	• All staff	• All staff	• Project teams	• Project teams	• Project teams
Objectives	• Present T1 survey results	• Agree on project problem areas	• Gain an overview of the process	• Generate solution ideas, prioritize and select solutions	• Manage change
	• Familiarize participants with LSS and CPS tools	• Draft project definition	• Select vital root causes	• Describe solutions	• Organize support for solutions to be implemented
	• Raise confidence in engaging in result-driven improvement activities	• Identify project teams and sponsors	• Identify potential process gaps	• Plan implementation	• Sustain long-term gains
	• Overcome innovation-hampering mindsets		• Support process maps with data		
Tools trained	• Voice of customers (VOC)*	• VOC	• Future scenario*	• Idea box*	• Change- management plan
	• Kano analysis	• Kano analysis	• SIPOC	• Webbing*	• Stakeholder-engagement strategies
	• Future scenario*	• Project charter	• VSM	• SCAMPER*	• Force-field analysis
	• SIPOC	• Future scenario*	• Seven wastes	• Analogies*	• Solution-effect analysis
	• Value stream map (VSM)	• Idea box*	• Takt time	• Forced connection*	
	• Seven wastes	• Stakeholder analysis	• Basic hypothesis tests	• Reverse brainstorming*	
	• SCAMPER*		• Regression analysis	• Effort-impact matrix	
	• Forced connection			• Action plan	
Deliverables	• Customer feedback sum-up	• Customer feedback sum-up	• Process maps	• Solution ideas	• Stakeholder- support level map
	• Clear problem statement	• Clear problem statement	• Potential root causes	• Selected and described solutions	• Stakeholder intervention plan
	• Objectives	• SMART objectives	• Data metrics and potential root causes	• Implementation plan	• Communication plan
	• Problem areas' metrics	• Metrics for problem areas and objectives	• Vital few root causes		• Performance monitoring plan
			• Process gaps list		

Notes: The tools marked with an asterisk (*) are Creative Problem-Solving (CPS) tools; the others are well-known Lean Six Sigma (LSS) tools

Appendix 1

Appendix 2. Survey items used for the core variables

Creative role identity – Farmer *et al.* (2003), on a seven-point Likert scale ranging from strongly disagree (1) to strongly agree (7)

- I often think of being creative.
- I do not have any clear concept of myself as a creative employee. (reversed coded)
- To be a creative employee is an important part of my identity.

Innovative work behavior – Janssen (2000), on a seven-point Likert scale ranging from strongly disagree (1) to strongly agree (7)

- I generate new ideas for improvement.
- I mobilize support for innovative ideas.
- I search out new working methods, techniques or instruments.
- I attempt to convince people to support an innovative idea.
- I transform innovative ideas into applications.
- I generate original solutions to problems.
- I systematically introduce innovative ideas into work practice.
- I make key organizational members enthusiastic for innovative ideas.
- I evaluate thoroughly the application of innovative ideas.

Transformational leadership – Bass and Avolio (1997), on a seven-point Likert scale ranging from never (1) to always (7)

- My manager gets me to look at problems from many different angles.

Because this validated questionnaire is licensed, all other Multifactor Leadership Questionnaire items can be retrieved via Mindgarden: www.mindgarden.com/multifactor-leadership-questionnaire/225-mlq-rater-transform-survey-hosting.html

Appendix 3. Focus group interview guides

Employees focus group interview guide

Questions related to the perception of own creative role identity

- What does innovation mean to you in your daily work?
- In what way do you see creativity and innovation as part of your functional role?

Questions related to employee needs

- Do you feel that you have the knowledge and skills to innovate at work?
- If yes, please share with us the knowledge and skills you have applied so far to innovate at work. How did you acquire these knowledge and skills? What was the enabling condition for your application of these knowledge and skills?
- If no, please share with us what makes you say that? What is missing? What were the roadblocks you faced when you try to apply innovation and creativity at work?

Questions related to perceived leadership support for innovation

- When was the last time you sought a new idea to solve a problem or to introduce change at work? What was the idea?
- How did your manager react to your contribution? What did your manager say?
- What about your colleague(s), what was their reaction? What did they say?
- What kind of support do you need more of?

Managers focus group interview guide

Questions related to the perception of own creative role identity

- What does innovation mean to you in your daily work?
- In what way do you see creativity and innovation as part of your functional role?

Questions related to managers' needs

- Do you feel that you have the knowledge and skills to innovate at work?
- If yes, please share with us the knowledge and skills you have applied so far to innovate at work. How did you acquire these knowledge and skills? What was the enabling condition for your application of these knowledge and skills?
- If no, please share with us what makes you say that? What is missing? What were the roadblocks you faced when you tried to apply innovation and creativity at work?

Managers' roles in enabling employees to innovate at work

- When was the last time you encouraged your employees to solve a problem by being innovative? How did you do it? What was the outcome? How did your employees react to it?
- What behaviors would you like your staff to show more of?

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