Building an improvement culture: an action research approach in a construction company

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Scholars suggest that the culture of construction companies has changed towards focus on projects and acceptance of low quality and slow innovation rates. This action research project aimed to investigate these suggestions in practice and to facilitate the development of an improvement culture in a construction company. The longitudinal study featured a series of workshops coined as improvement projects (IPs) to achieve this. The problem-solving workshops provided social outcomes, as self-efficacy and motivation amongst practitioners increased. The desired task-related outcomes were not achieved, since existing culture and lacking management support overruled well-crafted action plans. Employees prioritised project work over improvement activities, which hampers the development of an improvement culture. Altogether, IPs can contribute to developing culture, but their sole implementation is not a short-cut route towards long term success.

Keywords: construction industry, culture, improvement culture, continuous improvement, process, behaviour, motivation, self-efficacy

1 Introduction

The current nature of the construction industry requires creative behaviours and adaptability to changing environments. Construction companies intend to improve their performance by implementing new management paradigms (Winch, 2003; Tezel, Koskela and Aziz, 2018). On the surface, these paradigms add process-related techniques and mechanisms to the organisational practice (Miron *et al.*, 2016), but the application of these instruments alone is not a guarantee for competitive advantage. The underlying ***improvement culture*** can make the difference between success and failure (Dombrowski and Mielke, 2013; Swartling and Poksinska, 2013).

Culture (the behaviour patterns or 'the way we do things around here') is specific to a company and cannot easily be duplicated (Bessant, Caffyn and Gallagher, 2001). Managers in the construction industry mostly focus on tangible aspects of their company, such as technologies and types of contracts. They prioritise it over intangible aspects such as human resources and culture, which can be explained by their educational background (Pries *et al.*, 2004). Therefore, culture is a highly untapped resource of competitive advantage in the technical-oriented construction industry.

The potential benefits of an improvement culture in a construction company provided motivation for a longitudinal action research project. It introduced a program of ***improvement projects*** (IPs), where employees from different functions cooperate in a series of problem-solving workshops. Thus, this paper's main question is:

How can IPs contribute to an improvement culture in a construction company?

To develop an improvement culture, ***a combination of task-related and social outcomes*** is required (Nicolini, 2002; Van Dun and Wilderom, 2012). IPs can contribute to such outcomes (Farris *et al.*, 2008; Miron *et al.*, 2016), but these have not been studied in the context of culture in a construction company. Therefore, the sub-questions of this study are:

- ***How can IPs contribute to task-related outcomes in a construction company?***
- ***How can IPs contribute to social outcomes in a construction company?***

This paper first addresses the theoretical framework. Next, the methodology is explained. Followingly, the longitudinal results are illustrated. These are then discussed in a broader context to answer this study's research questions and provide recommendations for future application.

2 Theoretical framework

This section firstly addresses the need for cultural change in the construction industry. The second sub-section illustrates various approaches for such cultural change. Thirdly, the IP mechanism and its potential contributions to an improvement culture in a construction company are displayed. This section lastly presents three models are presented that can help in observing cultural changes.

2.1 The construction industry

Dubois & Gadde (2002) characterised the construction industry as a *loosely coupled system*, which is complex because of interdependence and uncertainties in construction projects. Construction companies have adapted their culture to this environment through "tight" *intra-project couplings* (within individual projects) and

"loose" *inter-project couplings* (between and across projects). This includes a prioritization of project focus over process focus, which hampers innovation and learning across projects (Dubois and Gadde, 2002).

In the past, the construction industry featured mature and well-understood technologies, which made it easy to cooperate and to maintain cohesion within organisations and construction projects. Focus on projects and low costs was rewarded by clients, since tenders were awarded based on lowest price. Over the past years, these circumstances have changed. The shift towards quality and innovation led to fragmentation and specialisation across the construction supply chain, as it had in other industries for a longer time (Thomas *et al.*, 2002). While the circumstances changed, the culture has not evolved simultaneously. The focus still lies on cost and attainment of short-term goals. Thomas *et al.* (2002, p. 2) state that it has overshadowed essential elements of a successful project, such as 'openness, trust, respect and the development of long-term relationships'. Cultural change is an inert process (Swartling and Poksinska, 2013), and the long cycle times in construction add a factor to the slow development rate. This leaves construction companies with an obsolete culture, which is unable to adapt to the complexities of today's construction industry.

Successful companies break with these patterns in order to innovate (Dorée and Holmen, 2004). Concepts as 'project culture' (Thomas *et al.*, 2002), 'project chemistry' (Nicolini, 2002), 'organisational culture' (Hartmann, 2006), and 'social learning environments' (Hartmann and Dorée, 2015) are at the foundation of breaking these patterns. The recommendations are comparable: to motivate employees into improving their processes proactively by facilitating and inspiring them. Similar focus on processes and culture can be seen in management paradigms as *lean thinking* (Koskela, 1992; Hines, Holweg and Rich, 2004; Tezel, Koskela and Aziz, 2018) *continuous improvement* (Berger, 1997; Bessant, Caffyn and Gallagher, 2001), and *managing by values* (Dolan and Garcia, 2002). Leaders in these management philosophies act as role models and facilitate processes of *double-loop learning* (Argyris, 1976) and *social validation* (Schein, 2004). These processes evaluate the foundation for making decisions, by questioning existing ways of thinking, and introducing new ideas, which are gradually accepted or denied by the group. These processes continuously align and redevelop organisational culture, as featured in an ***improvement culture***. This study referred to it as part of the ***continuous improvement*** (CI) paradigm. Koskela has advocated application of such new philosophies in construction for the past three decades (Koskela, 1992; Koskela, Ballard and Tommelein, 2002; Miron *et al.*, 2016; Tezel, Koskela and Aziz, 2018). Exhibit 1 illustrates the main differences between traditional innovation and CI (Koskela, 1992).

	Innovation	**Continuous improvement**
Focus	Efficiency of conversions	Efficiency of flow processes
Goal	Leaps in efficiency	Small steps, details, finetuning
Involvement	Company and outside specialists, champions	Everybody in the company
Time frame	Intermittent and non-incremental	Continuous and incremental
Technology relied upon	Outside technological breakthroughs, new inventions, new theories	Internal know-how, best practice
Incentive	New superior technology or need for capacity extension	Overcome constraints in variability reduction or cycle time compression
Practical requirements	Requires large investment, but little effort to maintain it	Requires little investment, but great effort to maintain
Mode of action	Scrap and rebuild	Maintenance and improvement
Transfer-ability	Transferable: embodied in individual equipment and related operating skill	Primarily idiosyncratic: embodied in system of equipment, skills, procedures and organisation
Effort orientation	Technology	People

Exhibit 1: The differences between the paradigms of "innovation" and "continuous improvement" (Koskela, 1992, p. 24)

2.2 Cultural change

Needless to say, the shift from traditional culture (innovation, Exhibit 1) towards an improvement culture (CI, Exhibit 1) requires a transition. This involves ***task-related outcomes*** (such as quality of problem-solving and adoption of innovative solutions) and ***social outcomes*** (such as mutual understanding, motivation, morale, and dedication) (Nicolini, 2002). This study aimed to observe longitudinal changes in task-related and social outcomes. Firstly, ***CI behaviour*** represents the task-related types of behaviour, similar to *innovative work behaviour* (Janssen, 2000). This is motivated through the social system of an organisation. Bottom-up factors are main predictors for behaviour in a situation of self-authorization, such as construction projects. If a person wants to do something (motivation) and believes he can and must do it (self-efficacy), he is more likely to enact that behaviour (Ajzen, 1991; Parker, 1998). Therefore, this work also studies ***CI motivation*** and ***CI self-efficacy***. The fourth and final variable is ***perceived organisational support*** (Eisenberger *et al.*, 1986), since the employees' image of managerial practice is crucial in cultural change (Van Dun and Wilderom, 2012, p. 141). The combination of these four variables features bottom-up efforts, top-down efforts, task-related outcomes, and social outcomes. Several routes can be taken towards improvement of these variables (Van Dun and Wilderom, 2012; Tezel, Koskela and Aziz, 2018).

The following paragraphs review and compare two models of cultural change: the *normative systems model for organisational change* (Ogbonna, 1990, based on Silverzweig & Allen) and the *hypothetical model on team*

culture evolution (Van Dun and Wilderom, 2012). These provide two perspectives on the development of culture.

The *normative systems model for organisational change* (Ogbonna, 1990) defines a sequence of four activities for organisational change (Exhibit 2). *Analysing the existing culture* enables deciphering culture, which is at the base of improvement (Argyris, 1976; Dolan and Garcia, 2002; Schein, 2004). *Experiencing the desired culture* enables employees to establish a desired culture, which involves questioning old beliefs and comparing them to positive aspects of a culture that is encouraged. *Modifying the existing culture* emphasises the *norm gap* between the existing and desired culture. It facilitates and motivates employees to change towards the desired culture. *Sustaining the desired culture* features 'on-going evaluation and renewal' of the organisational culture. The model recommends an iteration of the four steps if the desired culture is not achieved (Ogbonna, 1990).

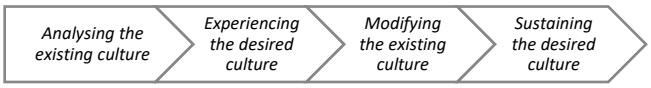

Exhibit 2: Normative systems model for organisational change (Ogbonna, 1990)

The *hypothetical model on team culture change* (Exhibit 3) describes cultural change as a result from *exogenous enablers* and *endogenous human dynamics*. The combination of *high team performance* and *team climate change* will result in team culture change. The facilitation of culture change is a dynamic process, which requires reflection about visible and more tacit organizing ingredients (Van Dun and Wilderom, 2012, p. 143).

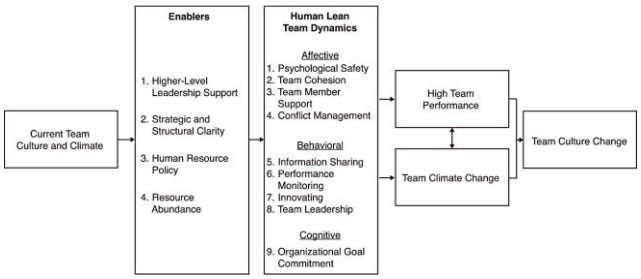

Exhibit 3: Hypothetical model on evolving a team towards a Lean team culture (Van Dun and Wilderom, 2012)

Whereas Ogbonna (1990) described cultural change as a manageable roadmap (managers can change culture), Van Dun & Wilderom (2012) have characterised cultural change as a dynamic and team-specific process. Both models mention iterative reflection as a crucial step in culture development. Detecting and changing discrepancies in behaviour is crucial in personal development (Argyris, 1976; Aspinwall, 2005).

2.3 Improvement projects

This work aimed to set up a low-threshold program which could contribute to an improvement culture. This included two ***improvement projects*** (IPs), which are also named *Kaizen* (Emiliani, 2005), *Kaizen events* (Farris *et al.*, 2008; Glover *et al.*, 2013), or *Quality Circles* (Miron *et al.*, 2016). The construction company preferred a "hands-on" terminology that fitted the project-oriented industry. Following the *continuous improvement* and *improvement culture* terminology, the term "improvement project" was coined and used in the study.

In an IP, employees with different functions (cross-functional) participate in a sequence of problem-solving workshops. The prescribed roadmap can be modified to the organisational needs. Problem-solving involves simple yet effective tools and principles. It is based on logical thinking, in-house knowledge, "just-in-time" training, and cross-functional interaction between employees who would normally be disconnected. It is chosen for this study because of the low implementation threshold: it involves a relatively small investment, which can result in both task-related and social outcomes (Emiliani, 2005; Farris *et al.*, 2008). The reflective nature of IPs can contribute to the desired cultural change and personal development (Aspinwall, 2005; Van Dun and Wilderom, 2012).

This section has now introduced why cultural change is needed in the construction industry, how other approaches aim to achieve this, and how this study has aimed to achieve this. The final sub-section describes how elements of culture can be observed in practice.

2.4 Observing culture

Observing culture can be a complex matter for both scholars and practitioners. To simplify this, scholars categorised multiple levels of culture, which range from shallow (easy to observe) and deep (hard to observe). Argyris (1976), Schein (2004), and Sinek (2009) are three frequently referenced authors in the field of culture. The following paragraphs illustrate their concepts, after which they are compared.

Firstly, Argyris (1976) differentiated two levels of decision-making and behaviour: ***espoused theories of action*** are ideas that people advocate as a foundation for their actions. A stronger predictor is more deeply embedded in the minds of people: ***theories-in-use*** are the foundation for actual behaviour. In practice, there are discrepancies between how people espouse to behave and how they actually behave, but these are rarely discussed for reasons of threats and anxiety. However, awareness about them can strongly contribute to behavioural change.

Secondly, Schein (2004) distinguished three levels of culture (pp. 25-37). At the surface of observation are ***artifacts***, the visible aspects and symbols of an organisation. It is difficult to decipher artefacts, since they have a deeper meaning and history of origin. Next, ***espoused beliefs and values*** can be found in organisational strategies, goals, and philosophies. When people envision a desired situation, they espouse their own beliefs and values, to communicate and make decisions. At the deepest level lay the ***basic underlying assumptions***. These are also beliefs and values, but more vastly embedded in people's minds, often unconscious and taken-for-granted. Basic underlying assumptions form the steady foundation of what people perceive as good or bad, which makes it the most important predictor of behaviour and the essence of culture.

Thirdly, Sinek (2009, pp. 37–39) has coined the concept of "The Golden Circle" as a 'naturally occurring pattern' in leadership of individuals or organisations. His model also consists of three levels. At the surface, there is ***what*** products or services are offered, which is easy to identify. Behind the products or services lies ***how*** the strategy is shaped: 'the differentiating or motivating factors in a decision' (p. 39). At the inside lies the ultimate motivation for organisations: ***why*** their company exists, what their actual purpose or cause is. *What* organisations do is the most tangible level, and *why* they do it is the least tangible level.

Exhibit 4 illustrates how the levels of these models can be compared. Argyris and Schein (internal observation, academic literature) take a different approach than Sinek (external observation, popular literature), but all mention the importance of the least visible layer of culture (*theories-in-use*, *basic assumptions*, and the *why*). All three see the deepest level as the essence of company culture, which strongly influences daily behaviour, and thus competitive advantage. Directly visible levels are superficial in two ways: besides their immediate appearance, they carry less meaning.

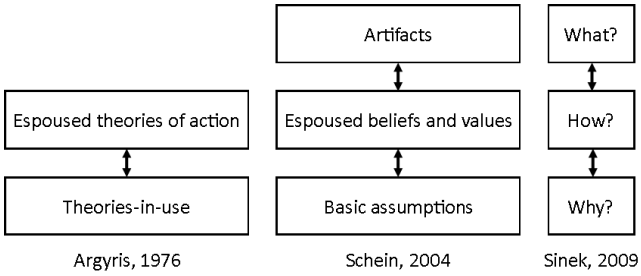

Exhibit 4: three models to observe culture (Argyris, 1976; Schein, 2004; Sinek, 2009)

3 Methodology

This study involved a branch of a large construction company, consisting of approximately 25 employees with a mainly technical background. No one had significant experience in CI. In the research preparation, employees stated that 'improvements are often not implemented due to our culture'. Therefore, this study aimed to test improvements in practice, instead of doing hypothetical inquiries. Detecting discrepancies within current culture requires 'instruments that focus on collecting relatively directly observable behaviour' (Argyris, 1976, p. 367). A basic research approach, which just uses interviews and observations, would only analyse superficial levels. It could investigate espoused theories of action and espoused values and beliefs but would not get to the essence.

To successfully investigate theories-in-use and to generate double-loop learning for the commissioning company and the researchers, this study has taken an ***action research*** (AR) approach. AR has an interventionist nature, which makes it suitable to study problems in a natural setting. The practitioners are involved in performing research, while the researcher participates in organisational practice (Coughlan and Coghlan, 2002). This provides a rich explanation for "how" and "why" phenomena occur. These strengths make it an appropriate method for construction management research (Azhar, Ahmad and Sein, 2010; Fellows, 2010; Voordijk and Adriaanse, 2016).

The application of AR brought several challenges, as did the implementation of CI through IPs. An action researcher should 'engage in both making the action happen and stand back from the action and reflect on it as it happens' in order to provide both managerial and scientific recommendations (Coughlan and Coghlan, 2002). This challenge is similar in evaluating CI, where the evaluator role should be between the *technician-employee* and the *scholar-scientist* (Miron *et al.*, 2016). Also, the IP facilitator is considered the most direct link between IP team members and the larger organisation. His role is 'to promote the change program, to help implementing it, to train team members, to guide meetings, to solve group's functioning problems, and to serve as a link between team and staff' (Wood, Hull and Azumi, 1983). To undertake these challenges, multiple perspectives are useful. Therefore, the researcher founded a research steering group composed of himself, the branch manager, and two project coordinators. The researcher took the role of change agent and facilitator of the IPs, while the project coordinators took the role of IP team leaders. The branch manager made time and materials available and he attended the first session of both IPs and the evaluation. The next paragraph describes the methods of inquiry that were used for central data collection and analysis.

After each IP session, the IP facilitator and team leader conducted a ***diary study*** (Sá, 2002), in which the IP dynamics and their possible background were analysed. This enabled the collection of preliminary results and discussion during the longitudinal study. The final IP session featured a ***group evaluation***. All participants were invited to reflect on the IPs and the preliminary findings of the study. To assess the impact on this study's constructs, all IP participants were asked to fill in an ***individual questionnaire*** after the IPs. Each question had two answer fields: *before IPs* (T1) and *after IPs* (T2). The 7-point Likert scale provided a quantitative rating for each variable on T1 and T2, and the change between them over time (Δ). The appendix illustrates the items and sources for each construct. When the IP program was finished, three bilateral and three group sessions of ***steering group reflection*** were organised.

4 Results

This section displays the results of the longitudinal AR and IP program, including planning, execution, evaluation, individual questionnaire, and steering group reflection.

The IP design contained tools which were easy to understand and to execute, based on Brook & Simpson (2009). The research steering group members agreed on four sessions of 2.5 hours each. Execution at the end of workdays would enable IP members to fulfil their job demands during the day, after which the IP sessions could take place. The sessions were designed as follows:

0. IP preparation
1. IP session 1 (2.5 hours)
    a. Problem analysis (mind map)
    b. Measurement (current and desired situation)
2. IP session 2 (2.5 hours)
    a. Process analysis (SIPOC diagram)
    b. Root cause analysis (fishbone diagram, 5 whys)
3. IP session 3 (2.5 hours)
    a. Brainstorming for solutions
    b. Form action plan with achievable combination of interventions

Execution of action plan

- Weekly pulse meetings for action plan status

4. IP session 4 (2.5 hours)
    a. Close action plan and initiate spin-offs
    b. Evaluate IP contents and dynamics
    c. Evaluate IP design

As IP preparation, the project coordinators synthesised a list of problems in one of their function-specific meetings. One week later, they selected two problems based on urgency and feasibility. These were the "purchasing procedure" in the project phase and the "information transfer" between the calculation phase and project phase.

The two project coordinators from the research steering group each led an IP team. The teams were composed based on availability, motivation, group dynamics, and affiliation with the problem (for example, the strategic purchaser was involved in IP 1). Exhibit 5 displays the IP sessions' dates and their members' attendance. The fundamental problem-solving sessions of both IPs took place within a month time. The average attendance for all sessions was 63% (41 out of 65 invitations led to a team member attending the session).

	IP 1		**IP 2**	
Session 1	1-4-2019	5/7	3-4-2019	5/7
Session 2	8-4-2019	4/7	11-4-2019	5/7
Session 3	15-4-2019	6/7	25-4-2019	6/7
Extra session	N/A		8-5-2019	5/8
Session 4 (evaluation)	10-7-2019	0/7	10-7-2019	5/8
Average attendance		**54%**		**70%**

Exhibit 5: IP sessions and attendance

4.1 IP 1: purchasing procedure

The project coordinators introduced a problem with the purchasing procedure, since they felt that the scale advantages of a big company were not utilised. The first session underlined their perception: there were too few blanket orders (Dutch: *raamcontracten*) with suppliers and subcontractors, which normally guide fixed prices and simplified arrangements for smaller projects. The lack of blanket orders led to many small contracts and big administrative efforts throughout the company. It also caused ambiguity around strategic procurement choices and double work during the project phase. The IP team set four indicators for change (Exhibit 6). The number of blanket orders, the percentage of successful evaluations and that of fully filled purchasing sheets should all increase. As a result, IP team 1 wanted to reduce the number of small contracts with big administrative efforts.

Indicator	**Existing**	**Desired**
Number of blanket orders	Ca. 10	35
Successful evaluations	0%	75%
Projects with purchasing sheet from start project (measure at transfer)	0%	75%
Number of contracts with "too many" lines	?	Lower

Exhibit 6: existing and desired situation of IP 1

The process analysis (SIPOC diagram, Exhibit 7) showed that current contracts require extensive steps, in which the strategic purchaser is not fully involved. As project coordinators all make their own purchasing choices, double work increases, and uniformity decreases.

The root cause analysis (fishbone diagram, Exhibit 8) revealed that this problem has spread organically over the past years, as the number of employees had grown exponentially. New colleagues were not properly instructed into working in a standardised way. This signal spread to the existing employees, which all "optimised"

their behaviour routines to work efficiently for themselves. Employees did not know about one another's ways of working, which complicated collaboration. The strategic purchaser could not facilitate the ways of working of project coordinators from two of the company's branches. It was unclear who had the leading role in standardisation and communication across the branch. Top management gave directions through detailed and complex instructions but did not oversee process performance indicators. This led to neglecting of procedures as a general way of working. The root causes gave starting points for the IP's action plan.

All team members took actions in the IP. One project coordinator would set up a low-threshold digital complaint system for big administrative efforts, and he would also organise an evaluation of subcontractors and suppliers. Another project coordinator would inform the calculators in order to align purchasing from the start of the acquisition phase, instead of reacting to problems in a later stage. A third project coordinator would analyse the current procedures for closing contracts, after which the project coordinators could update them. Simultaneously, the strategic purchaser would evaluate the need for suppliers and subcontractors across the branches, and he would issue blanket orders based on this.

The action plan was not executed as planned and agreed. The IP design prescribed pulse meetings, to reflect and to remind members of the action plan. After crafting the action plan in the third session, the team rejected to organise these pulse meetings, due to their full agendas with daily work. In the end, the action plan was partially executed, but IP members seemed more focused on productivity within individual projects.

S (Supplier)	I (Input)	P (Process)	O (Output)	C (Customer)
Calculation team Project management Subcontractors & suppliers Client Corporate system	Contract pieces Building specifications Drawings Cost estimates Opportunities Risks History of calculation phase Empty transfer form Quotations	Compose project team Plan transfer meeting Fill in transfer form (partially) Administration Execute transfer meeting Complete transfer form fully	Completed transfer form Reliable project team Image of the work: Opportunities Risks Calculation choices	Project team: Project coordinators Execution team Project management Administration Calculation

Exhibit 7: SIPOC diagram of IP 1

Man	Method	Management	Material	Machines	Environment
Lack of time Lack of communication New to the organisation Number of people (capacity) Lack of knowledge about process	Too many procedures Procuration Process is unclear Lack of uniformity Too many contract lines Process is too complex for temporary personnel	No clarity in leadership Lack of control Too much monitoring of results		Inflexible system ICT: software is too complex Too many different software suites Too many different templates	Branches work differently Project-directed purchasing is never standard Multiple contract forms

Exhibit 8: fishbone diagram outcomes of IP 1

4.2 IP 2: information transfer

The problem of the information transfer from calculation phase to project phase was addressed, because the project coordinators noticed ambiguity and double work across the organisation. Mistakes were not recognised early enough, and therefore not reported. The standardised procedure for transfers is hardly executed nor evaluated by anyone. The absence of a successful information transfer leads to confusion and double work, and thus failure costs. Besides, a lot of opportunities for innovation and collaboration are missed. The team set ambitious goals (Exhibit 9): it aimed to transfer all projects successfully. Furthermore, the amount of prescribed transfer forms should be reduced from 3 to 1, and the new form should cover 95% of the projects instead of the current 80%. Also, 100% of newly acquired projects should have a complete transfer form, while it currently lies beneath 50%.

Indicator	Existing	Desired
Percentage of "successful" transfers	?	100%
Number of standardised transfer forms	3	1
Coverage of transfer forms	<80%	95%
New projects with correctly and fully filled transfer forms	<50%	100%

Exhibit 9: existing and desired situation of IP 2

The process analysis (SIPOC diagram, Exhibit 10) illustrated the clear distinction between the calculation team and the project team for a project. After winning a project, all relevant information must be transferred from the calculation team to the project team, to optimise quality. Since it is not known on beforehand which information is relevant, there is a corporate standardised procedure which specifies a transfer meeting and form for every project. The IP team members agreed that the execution seems possible with the procedure, but not in the current context.

The root cause analysis (fishbone diagram, Exhibit 11) pointed out that the transfer meeting and form were hardly executed correctly. The long-term importance of the transfer was hardly known or emphasised across the branch. Therefore, employees were not really motivated to execute it, and they prioritised short-term activities. As a result, the transfer meeting and form are only ticked off. This creates administrative waste, unclarity, and a lack of information and motivation. Summarizing, the lack of priority causes a vicious cycle of inefficiency. The IP action plan capitalised on this, by addressing the importance centrally across the branch.

To ensure central organisation of transfer meetings in the future, the team involved the branch's tender manager and organised an extra session to design a pilot study. This was used to analyse the corporate forms and to set preconditions for a successful meeting. The team decided to change the execution, such as meeting arrangements, people involved, and ground rules. They decided not to change the forms itself. A recently acquired project was chosen as the subject for the pilot study, but the moment of transfer did not fit in the timeframe of the IP and this study. Therefore, it can be considered as an IP spin-off.

S (Supplier)	I (Input)	P (Process)	O (Output)	C (Customer)
Calculation team Project management Subcontractors & suppliers Client Corporate system	Contract pieces Building specifications Drawings Cost estimates Opportunities Risks History of calculation phase Empty transfer form Quotations	Compose project team Plan transfer meeting Fill in transfer form (partially) Administration Execute transfer meeting Complete transfer form fully	Completed transfer form Reliable project team Image of the work: Opportunities Risks Calculation choices	Project team: Project coordinators Execution team Project management Administration Calculation

Exhibit 10: SIPOC diagram of IP 2

Man	Method	Management	Material	Machines	Environment
Priorities not high or not clear Time Assumptions Knowledge Missing information for transfer Expectation patterns Unclarity of the meeting's purpose	Unclarity of process Structure of meeting No standardised method/ guidelines/ form Not all projects have the same parts Order of working is not logical	Everyone is busy Lack of time to do extra work Too much work per person	Roadmap is unclear Standardised forms are unclear or incomplete	ICT is not visual, so easier forgotten or ignored	Process has been modified or changed, forms have not Type of work has changed over the years

Exhibit 11: fishbone diagram outcomes of IP 2

4.3 Group evaluation

Initially, each IP featured a separate evaluation session, as designed by the steering group. Both evaluation sessions eventually were cancelled a few hours before the event. Therefore, a plenary session was planned two months after the final session of IP 2. From the fifteen invitees, only five attended the evaluation (also see Exhibit 5). The attendees evaluated the IP dynamics and background of mentioned problems. The most common theme in both IPs was the prioritization of daily work over improvement work. There were two root causes for this: the work environment and organisational support. The combination of these is a strong motivator for project-oriented behaviour, which deprioritised improvement work by employees.

Although IP members express the motivation and self-efficacy to execute improvement work, they do not seem to find time to actually do it. Standardising seems time-consuming, as it requires discipline, training, and communication throughout the branch. These are further complicated by the current work environment, as projects were scattered across the region.

Top management was result- and target-oriented. Employees never booked hours on improvement, as all working hours should contribute to project results. Management had not neglected process improvement, as some artifacts were aimed at improvement, such as lean courses, process standardisation and other improvement tasks by specialists. However, the accents in daily communication (emails and meetings) lay on projects and results. Employees did not get nor make time to put in improvement activities. Efforts of the past were rarely successful, and management showed a lack of continuity and a *scrap and rebuild* approach to organisational development (also see Exhibit 1).

The easy abandoning of artifacts in the past reduced their perceived importance, which starts a vicious cycle of neglecting such artifacts and lower success chances for new improvements. This history formed the underlying assumption to prioritise project work, results and short-term actions. Even though the action plans reflected espoused motivation to change, this did not lead to significant changes.

4.4 Individual questionnaire

The questionnaire was emailed to all IP members and paper copies were available at the branch office. As most employees were doing their work on-site, only two paper copies were filled in. Four questionnaires were returned through email, which brought the cumulative response rate to 6 out of 15 (40%). The results (Exhibit 12, also see appendix) underline the findings from the evaluation. CI self-efficacy and motivation strongly grew during the study. CI behaviour also increased, but not as significantly. The lack of change in the field of POS illustrates the lack of top management involvement in the IP program.

	T1 (1-7)	T2 (1-7)	Δ
CI self-efficacy	4,17	5,25	1,08
CI motivation	4,15	5,91	1,76
Perceived organisational support	4,56	4,59	0,03
CI behaviour	4,13	4,70	0,57
Average	**4,25**	**5,11**	**0,86**

Exhibit 12: questionnaire results (n=6)

4.5 Steering group reflection

The combination of low standardisation and no constancy of purpose created fuzziness about organisational values and direction. People had acculturated to focus on intra-project couplings, while loosening inter-project couplings. Consequently, the interest and priority for improvement activities were low, as employees did not see how lessons could be applied to their unique projects. Although there were good intentions to execute the action plans, employees found it hard to make time for process improvement as a separate activity. Standardisation certainly was a missing link.

The study showed that both the previous and present management actions led to a lack of inter-project focus in day-to-day behaviour. The priority to intra-project couplings became painfully clear, when top management issued a reorganisation at the end of the IP program. With this decision, all improvement work was put on hold, because they stated it did not contribute to current task-related results. This showcased the large gap between the current culture and the desired improvement culture.

The IPs emphasised the need for change to many participants. The action plans were drafted around the themes of *process standardisation* and *inter-project couplings*. Making time for improvement still seems an issue, which cannot be solved by only bottom-up efforts. Continuing current organisational practice would not be productive. The awareness about the need for CI and about a person's own influence on CI definitely improved. Two examples highlight this:

- IP 1 illustrated the differences in basic underlying assumptions between the strategic purchaser and project coordinators. Although the task-related problems could not be solved right away, the IP gave a clear signal to communicate better. Also, the project coordinators discovered the purpose of process standardisation, as it can improve the involvement of the strategic purchaser. They expressed that they should align their ways of working and to educate new employees accordingly.
- The team of IP2 initially desired to reduce the number of forms, by installing a customised version of it (Exhibit 9). In the end, the analysis turned out that the corporate procedure (meeting and forms, artifacts) were not the limiting factor. Instead, the execution (behaviour, basic assumptions) needed to be changed. Their initial view on the situation changed, which is an example of *double-loop learning*.

The dynamics of the IP program included elements of negotiation and discussion between researchers, employees, middle management, and top management. The lack of CI experience of key stakeholders was mitigated through a literature study and a case study at an experienced truck manufacturer. Since the concepts were fairly new to everyone involved, the AR and IP program turned out as a process of *social validation*. In the beginning, a lot of effort was taken to involve everyone and to make them enthusiast. These efforts reduced during the project towards participants who lacked attendance and motivation around the IPs. The desire for improvement throughout the branch partially turned out to be an *espoused theory of action* instead of a *theory-in-use*, due to other priorities and inertia of change.

5 Discussion

This section first aims to answer the research questions. After this, the limitations of this study are illustrated, followed by managerial and scientific implications.

How can IPs contribute to task-related outcomes in a construction company?

The IPs faced a strong orientation towards project activities and results, instead towards improvement activities and processes. Employees spent most of their working hours on project work and reactive problem-solving. The acculturated priority and perceived direction towards projects and results discouraged employees to focus on processes. The self-determination on construction projects led to a lack of learning and innovation, similarly described by Dubois & Gadde (2002). As Imai (1986, p. 74) argued: 'There can be no improvement where there are no standards!'. Although IP members intended to execute improvement activities, they did not succeed in making time for it. This led to a lack of improvement work and benefits to the task-related system.

How can IPs contribute to social outcomes in a construction company?

In contrast to the task-related system, the IPs did provide benefits to the social system of the construction company. The IPs brought several stakeholders together, which provided multiple perspectives on real problems in the company, whilst exposing and articulating fields of improvement. IP members indicated that the awareness about the possibilities of CI increased during the study: IPs articulated the purpose of process standardisation and improvement. The fact that IPs tackles real problems in a logical way appealed to the imagination of the project-oriented employees of the construction company. Besides, frustrations about existing problems were shared, captured and documented. This aligned the views of participants, which can be observed as processes of *social validation* and *team climate change*. The questionnaire underlines this: the constructs for CI motivation and CI self-efficacy show increasing numbers, which reflect a positive stance towards CI and the IP mechanism.

How can IPs contribute to an improvement culture in a construction company?

This study made designated efforts towards organisational improvement. While self-efficacy and motivation amongst employees increased during the IP program, it did not provide the desired behaviour. It emphasises again that cultural change is an inert process. As Swartling & Poksinska (2013, p. 84) stated: 'There is inertia in culture, which means that previous management actions influence the current culture, and present management actions will influence the future culture'. Organisational support and *underlying assumptions* from existing culture strongly influenced daily behaviours. They caused a focus on results and targets, which led to a lack of improvement. Newly installed artifacts did not get appropriate attention, since people had learned to reject and ignore them.

These results emphasise that bottom-up efforts towards an improvement culture are not effective without top-down organisational support. When top-down and bottom-up efforts are moving in opposite directions, improvement programs quickly seem like another useless exercise. Managers must act as role models to provide direction for employees. As Dolan & Garcia (2002, p. 103) put it: 'If a high-quality performance is expected from a more professional workforce, then the qualitative factors or values, such as trust, creativity or honesty, are of equal or greater importance than the traditional economic concepts like efficiency or return on investment'. This transition also requires *double-loop learning* from managers. Pries et al. (2004) illustrated that construction companies mainly hired managers with an educational background of engineering. Based on this, it is only logical that they manage by instructions, instead of values.

5.1 Limitations of this study

Action research takes place in a natural setting, which makes it 'expensive, difficult, and/or impossible to replicate' (Azhar, Ahmad and Sein, 2010, p. 90). Similarly, the dynamics of this IP program were unique. The starting point and longitudinal dynamics hampered successful implementation of the AR and IP program. Besides, the program had a limited timeframe, while culture has a slow rate of change. As the research steering group has parted ways after the program, the monitoring of IP effects has also stopped. Therefore, the bigger influences of IPs on cultural elements are not known at the moment of writing.

5.2 Managerial implications

This work has – again – addressed the tension between a project and a process focus in the construction industry. Comparing the construction company to a manufacturing company emphasises the lack of process orientation. The shorter cycle times in manufacturing industries enable immediate modification of processes and optimisation of standardised procedures, as in *design of experiments* (Brook and Simpson, 2009). Contrastingly, the interdependences and uncertainties in construction complicate experimenting in a controlled setting. Due to long cycle times, desired IP actions could not be executed or tested immediately. This is typical for the construction industry and can be an explanation for the lack of incremental innovation.

On the other hand, the unique character of construction projects makes them suitable for a pilot study. IP 2 tested their actions explicitly on a newly acquired project, which tightens the network couplings between an improvement program and daily productivity. The initial implementation of IPs as a separate program complicated the execution of action plans, which was seen in IP 1. It might be interesting to link an improvement project to a construction project on beforehand, which generates a testing atmosphere for pilot studies of the IP team. The concrete possibilities for application might just motivate the action-oriented and self-determined employees in the construction industry.

Construction companies can't duplicate the culture or ways of working of other industries. It can be assumed that the engineering paradigm will maintain to be dominant in the industry. Therefore, construction managers must find their own application of principles, mechanisms and values. It is their task to shape an environment of innovation. As construction projects are unique entities, each and every one of them will feature some innovation. The CI paradigm could help them to control organisational practice and to indicate the boundaries of the employees' "playground". Because making creative and exciting construction projects is why most people joined the industry in the first place.

5.3 Scientific implications

The IPs were not only useful for improving organisational practice. They proved to be a suitable tool for conducting construction management research too. Whilst interviews are often used to analyse an organisation, they might leave scientists with questions as: 'Why do practitioners say one thing and do the other?'. An IP can help to uncover cultural discrepancies: it looks for gaps between *espoused beliefs and values* and enacted behaviour, hereby addressing and articulating fields of improvement. This study's combination of AR and IPs has contributed to an analysis on the essential level of *basic underlying assumptions*. It uncovered actual problems, which limit the organisation on a daily basis.

While scientists advise a culture of collaboration in the construction industry, the academic culture of construction management research may need to evolve as well. This message was already advocated by Seymour and Rooke (1995), but is still relevant today. This longitudinal study has shown that both practitioners and researchers profit from constancy of purpose in practice, as a lack of direction brings limited results for both parties. The use of AR in a larger context and longer timeframe could help to develop best practice for construction managers and researchers. Establishing stable collaborations between educational and practitioner organisations (e.g. the CIRCA programme, Bessant, Caffyn and Gallagher, 2001) could contribute to this, for example in the form of a *PhD* or *PDEng* programme.

6 Conclusion

This study investigated how IPs can contribute to an improvement culture in a construction company. It has shown that simultaneous efforts on the work floor and in the boardroom are necessary to achieve this. Concludingly, IPs are useful for analysing behavioural patterns, which form the essence of culture. They can effectively expose general problems in the daily ways of working. They can help in designing accurate measures to solve these problems and in improving the organisation over time. However, if top management refuses to pay attention to improvement – both literally and figuratively – the development of an improvement culture and competitive advantage will also remain hypothetical.

7 References

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8 Questionnaire items and responses

	CI self-efficacy: from *Understanding of Continuous Improvement* , and *Skills* (Farris *et al.*, 2008, p. 60)
CISE1	I understand what continuous improvement is.
CISE2	I understand how continuous improvement can be applied in the construction industry.
CISE3	I understand the need for continuous improvement.
CISE4	I understand my role in continuous improvement.
CISE5	I can communicate new ideas about improvements.
CISE6	I am able to measure the impact of changes made to this work area.
CISE7	I possess sufficient continuous improvement skills.
CISE8	I am comfortable working with others to identify improvements in this work area.
	CI motivation: from *Affective commitment to change* and *Attitude* (Farris *et al.*, 2008, pp. 60–61)
CIM1	I believe in the value of improvement projects.
CIM2	I think that this improvement project is a good strategy for this work area.
CIM3	I think that it is a mistake to hold improvement projects. (R)
CIM4	I think that Improvement projects serve an important purpose.
CIM5	I think that things will be better with continuous improvement.
CIM6	I believe that holding this improvement project was needed.
CIM7	I am motivated to perform better in my work area.
CIM8	Continuous improvement increases my interest in my work.
CIM9	I like being part of improvement projects.
	Perceived organisational support: from *Short version of the survey of perceived organisational support* (Eisenberger *et al.*, 1986)
POS1	The organization values my contribution to its well-being.
POS2	If the organization could hire someone to replace me at a lower salary it would do so. (R)
POS3	The organization fails to appreciate any extra effort from me. (R)
POS4	The organization strongly considers my goals and values.
POS5	The organization would ignore any complaint from me. (R)
POS6	The organization disregards my best interests when it makes decisions that affect me. (R)
POS7	Help is available from the organization when I have a problem.
POS8	The organization really cares about my well-being.
POS9	Even if I did the best job possible, the organization would fail to notice. (R)
POS10	The organization is willing to help me when I need a special favour.
POS11	The organization cares about my general satisfaction at work.
POS12	If given the opportunity, the organization would take advantage of me. (R)
POS13	The organization shows very little concern for me. (R)
POS14	The organization cares about my opinions.
POS15	The organization takes pride in my accomplishments at work.
POS16	The organization tries to make my job as interesting as possible.
	CI behaviour: from *Innovative work behaviour* (Janssen, 2000)
CIB1	Creating new ideas for difficult issues (idea generation);
CIB2	Searching out new working methods, techniques, or instruments (idea generation);
CIB3	Generating original solutions for problems (idea generation);
CIB4	Mobilizing support for innovative ideas (idea promotion);
CIB5	Acquiring approval for innovative ideas (idea promotion);
CIB6	Making important organizational members enthusiastic for innovative ideas (idea promotion);
CIB7	Transforming innovative ideas into useful applications (idea realization);
CIB8	Introducing innovative ideas into the work environment in a systematic way (idea realization);
CIB9	Evaluating the utility of innovative ideas (idea realization).

Exhibit 13: questionnaire items and sources

CI self-efficacy	**T1 (1-7)**	**T2 (1-7)**	**Δ**
CISE1	4,00	5,67	1,67
CISE2	3,83	5,17	1,33
CISE3	5,33	6,00	0,67
CISE4	3,67	5,33	1,67
CISE5	3,67	4,67	1,00
CISE6	3,33	4,17	0,83
CISE7	4,33	5,33	1,00
CISE8	5,17	5,67	0,50
CI motivation	**T1 (1-7)**	**T2 (1-7)**	**Δ**
CIM1	5,33	6,00	0,67
CIM2	4,33	5,67	1,33
CIM3 (R)	*1,80*	*1,80*	*0,00*
CIM4	4,67	5,67	1,00
CIM5	5,17	5,83	0,67
CIM6	4,50	5,50	1,00
CIM7	5,17	5,67	0,50
CIM8	4,83	5,33	0,50
CIM9	4,83	5,33	0,50
Perceived organisational support	**T1 (1-7)**	**T2 (1-7)**	**Δ**
POS1	5,00	5,00	0,00
POS2 (R)	*2,67*	*2,67*	*0,00*
POS3 (R)	*4,33*	*4,17*	*-0,17*
POS4	3,83	3,83	0,00
POS5 (R)	*2,50*	*2,50*	*0,00*
POS6 (R)	*3,67*	*3,67*	*0,00*
POS7	4,67	4,67	0,00
POS8	4,17	4,33	0,17
POS9 (R)	*3,00*	*3,00*	*0,00*
POS10	5,00	5,00	0,00
POS11	4,83	4,83	0,00
POS12 (R)	*4,00*	*4,00*	*0,00*
POS13 (R)	*3,50*	*3,50*	*0,00*
POS14	4,67	4,83	0,17
POS15	4,50	4,50	0,00
POS16	4,00	4,00	0,00
CI behaviour	**T1 (1-7)**	**T2 (1-7)**	**Δ**
CIB1	4,33	5,17	0,83
CIB2	4,33	5,00	0,67
CIB3	4,50	4,83	0,33
CIB4	4,33	5,17	0,83
CIB5	4,50	5,17	0,67
CIB6	3,83	4,33	0,50
CIB7	4,00	4,50	0,50
CIB8	4,00	4,33	0,33
CIB9	3,33	3,83	0,50

Exhibit 14: questionnaire responses per item (n=6)