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# MEASURING PROJECT’S TEAM CULTURE IN PROJECTS USING THE LAST PLANNER® SYSTEM

Gunnar J. Lühr<sup>1</sup>, Marian G.C. Bosch-Rekvelde<sup>2</sup>

## ABSTRACT

At this stage, construction industry is known for bad project performances and a culture characterized by adversarial behaviours. The Last Planner® System (LPS) is designed to improve these circumstances through the enhancement of workflow reliability by involving various disciplines in joint planning processes and a culture of collaboration. How to actually measure related project team culture (PTC) is unknown at this stage. This paper tries to close this gap and compares two defined versions of the Ideal Lean Culture for organizations with the actual PTC in projects using the LPS.

It first presents the two Ideal Lean Cultures for organizations, based on a framework developed for organizations (the Competing Values Framework - CVF). Next, it examines on the basis of three case studies the applicability of the CVF for measuring the actual culture in project teams using the LPS and compares it with the named Ideal Lean Culture conditions.

The paper concludes that the CVF is a suitable tool to take a snapshot of the PTC and that the comparison to the Ideal Lean Culture can give conclusions about the current project team’s maturity in projects using the LPS.

## KEYWORDS

Project Team’s Culture; Last Planner® System; Competing Values Framework; Lean Culture

## INTRODUCTION

In the past, the construction industries’ tough competition, especially in times of recessive markets, led to unprofitable contracts for the contractors which led to a focus on claims instead of partner-like project conditions (Racky 2008). Adversarial and distrustful relationships between the parties (Beach et al. 2005), antagonistic behaviours (Beach et al. 2005; Johnston and Lawrence 1988) and escalating relationships (Racky 2008) led to a corresponding culture in the construction industry. “Culture” is hereby “the collective programming of the mind which distinguishes the members of one group or society from

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those of others” (Hofstede 1984, p. 82). As a result, bad project management performance (Flyvberg and Sunstein 2016; Owen and Koskela 2006) and slow project progress with problems like low productivity, insufficient quality, time over-runs, and poor safety hindered the value delivered to the customers (Senaratne and Wijesiri 2008).

The LPS has the aim to overcome these conditions. It is a continuous planning process with the aim to “improve the predictability and reliability of construction production” through the management of “relationships, conversations and commitments that together enable program & production planning decisions to be made collaboratively at the lowest possible level” (Mossman 2015, p. 2). LPS’ main difference to traditional construction management methods, where the projects get planned through individual professional planners and project managers (Mossman 2015), is that the various stakeholders plan the next work packages in a cooperative and integrative way (Verein Deutscher Ingenieure 2017). The project is divided into various scheduling hierarchies with different levels of detail whereas the preciseness gets refined at each level, as the time gets closer to the start of the task (Frandsen and Tommelein 2015). The “Last Planner” is preferably the last person in the value chain (usually the foreman or site manager of the appropriate trade or for planning tasks, the specialist planner or team leader of a discipline (Verein Deutscher Ingenieure 2017)). The schedules get normally visualized through sticky notes in regular meetings.

A corresponding project culture of collaboration is necessary to apply LPS successfully, which differs to the conventional culture at construction projects. To reach such an intended culture, it is necessary to define the target conditions and compare the actual situation to investigate what has to be adjusted (Paro and Gerolamo 2017).

Literature suggests systems to measure and describe the characteristics of organization cultures. One example is the Competing Values Framework (CVF) by Cameron and Quinn (2011), specifically for organizations. Paro and Gerolamo (2015, 2017) use this framework to define the Ideal Lean Culture for organizations.

For measuring projects’ cultures, however, the literature suggests a gap (Zell 2009). The differences between the organization- and project cultures occur due to the special project’s particularities as their uniqueness, their temporal limitation and their multi-disciplinarily (International Project Management Association 2015). Additionally, the unique circumstances of the construction industry, like the one of a kind production, site production, temporary multiorganization and intervention of regulatory authorities (Koskela 1992), project teams with various interests (Baiden et al. 2006) and LPS’s focus on collaboration, influence an appropriate project culture.

This paper aims to close this gap through investigating the application of the CVF at three different case studies that use the LPS. The case results are compared to the Ideal Lean cultures from the studies of Paro and Gerolamo (2015, 2017) and conclusions are drawn. The overall aim of this research is to investigate if the CVF is a suitable tool to measure the PTC regarding the Ideal Lean culture’s characteristics in LPS projects.

## **THE COMPETING VALUES FRAMEWORK AND THE IDEAL LEAN CULTURE**

As “Projects today have dramatically increased in complexity, requiring a culturally and functionally diverse mix of individuals who must be integrated into an effective unit – a project team” (Ranf 2010, p. 657), we are interested in the current state of the individual project team’s culture and whether it could be influenced to improve the project performance.

Zell (2009) suggested that a method to measure a project team’s culture is missing. To close this gap, he created an empirical measurement system with seven dimensions ((1) performance- and quality orientation; (2) cost- and target date orientation; (3) customer orientation; (4) innovation- and safety orientation; (5) strengths and homogeneity; (6) project orientation; (7) trust- and cooperation willingness) to measure and describe the PTC. Unfortunately, data of conducted studies with this model are missing.

An established method for the measurement of an organization’s culture with data from different industries is the CVF by Cameron and Quinn (2011). This framework is selected for this paper because was it used for various studies about the Lean management culture and data was available.

The CVF uses the “Organizational Culture Assessment Instrument” (OCAI) to measure and describe an organization’s culture and to facilitate change towards a target condition (Cameron and Quinn 2011). The framework is divided into two dimensions and four quadrants. One dimension “differentiates effectiveness criteria that emphasize flexibility, discretion and dynamism from criteria that emphasize stability, order, and control” while “the second dimension differentiates effectiveness criteria that emphasize an internal orientation, integration, and unity from criteria that emphasize an external orientation, differentiation, and rivalry” (Cameron and Quinn 2011, pp. 38 - 39). The OCAI and CVF are carried out through a standardized survey. The participants have to divide six times 100 points among four alternatives, depending on the similarity of their perceived culture (ibid, pp 29-32). Respectively one of the four questions belongs to one of the quadrants and the mean of the six belonging scores represents the individual score of the quadrant. The mean of the scores of all participants represent the score for the culture (ibid, p. 33).

Rudimentarily described, the four quadrants stand for the following characteristics (Paro and Gerolamo 2017)

1. Clan (Collaborate) – sense for the group or family, focus on the development of people and the team spirit
2. Adhocracy (Create) – characterised by temporary, specific and dynamic focus
3. Hierarchy (Control) – high level of work standards, rules and procedures to keep the control of the internal operations
4. Market (Compete) – external focus on suppliers and customers to obtain a competitive advantage

Paro and Gerolamo (2015) analysed the 14 Toyota Way Principles by Liker (2004) that describe the principles of Toyotas organizational culture as the root of Lean Management and estimated which of the four quadrants are affected by each of the 14 principles.

Shape A in Figure 1 shows their interpretation of the “Theoretical Ideal Lean Culture” (TILC). In their publication from 2017, they renamed it into “Theoretical Toyota Culture”. The focus is especially on the “establishment of rules, procedures and standards of work, organizational directives way to be followed by the employees, focusing on operational management or “micromanagement””. The distribution between the market- and the clan quadrant are balanced and the adhocracy quadrant has a low score. In another study, Paro and Gerolamo (2017) conducted a survey with 51 Brazilian Lean System experts who are in charge to implement Lean systems to define the Ideal Lean Culture from their perception. The outcome of this study is presented with shape B in Figure 1.

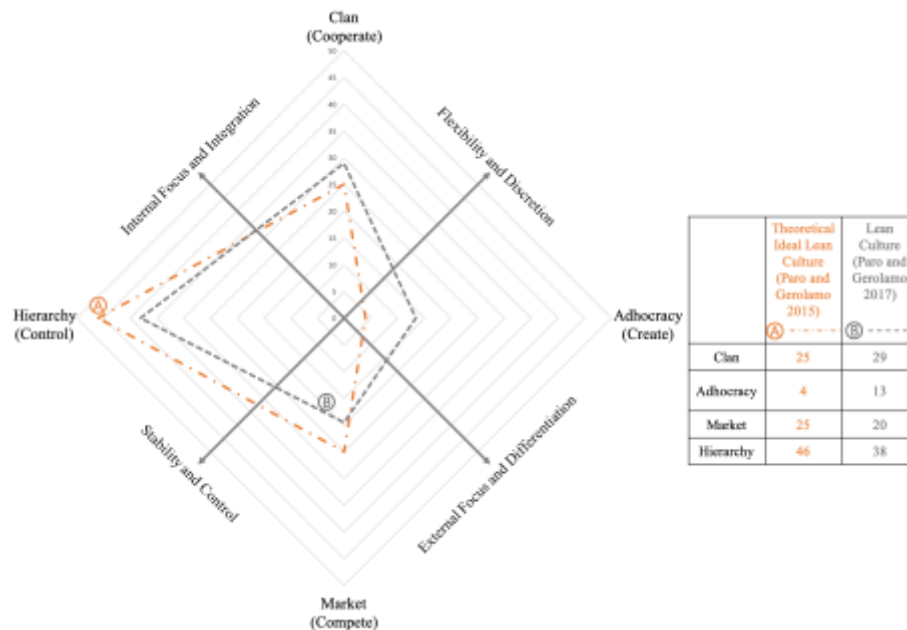


Figure 1 - Theoretical Ideal Lean Culture by Paro and Gerolamo (2015) and the Lean Culture by Paro and Gerolamo (2017)

Both studies show that the Ideal Lean Culture is mainly characterized by the characteristics of the hierarchy quadrant. The earlier study interprets this section as even more pronounced. The adhocracy quadrant from the TILC is less pronounced than the Lean Culture from the second study: the Brazilian Lean experts see the Ideal Lean Culture more flexible and external focussed. While the distribution of the clan- and the market quadrants are balanced at the TILC, the Brazilian Lean experts evaluate the clan characteristics as lightly more pronounced than the focus on the market characteristics. Paro and Gerolamo (2017) point out that the findings of the second study might be influenced by Brazilian particularities.

This paper compares the PTC’s of three cases with both studies to investigate if the application of the CVF is useful for LPS projects and if the comparison to the TILC and the Lean Culture allows conclusions about the maturity of the PTC and the success of the LPS.

## **CASE STUDIES**

The CVF survey was conducted in written form at three cases. In addition, further case study research methods like observations and interviews were done to get a deeper understanding about the contemporary situation and the circumstances of the survey (Ridder 2017; Yin 2018). The selected cases differ in multiple ways in terms of team size, the stakeholder types and the construction activities. These variations allow to obtain information about a phenomenon within various circumstances (Flyvberg 2006) and therefore enhance the generalizability of this study's results. The author, employed by the general contractor of the three cases, is in all case studies responsible to implement the LPS and to facilitate the appropriate meetings. Through this direct participation, background information and observations can be added to the research.

The CVF is designed for assessing organizational culture (Cameron and Quinn 2011, p. 27) and not to assess a project team's culture. As it is assumed that there are differences between organizational cultures and project cultures, the applicability of the CVF is also part of the investigation. Nevertheless, the survey's standard questions were chosen, similar to the original framework.

### **CASE 1**

The first project is the construction of an office building with parts of a historical façade and high-grade rental area for office areas and gastronomy. The investor has divided the project into two contracts with two different contractors: one for the reinforced concrete construction activities and one for the technical building equipment and the interior work (which is a joint venture of two organizations). The participating stakeholders at the regular LPS meetings are the investor (investment managers technique), the contractor for the reinforced concrete construction activities (mostly one senior site manager and one site manager), the joint venture for technical building equipment- and interior work (various site managers and foremen), various specialist planners (commissioned by the investor) and various sub-contractors (site-managers and foremen - commissioned by the joint venture). 16 people, spread over these stakeholder groups, participated in the survey to measure the PTC.

At the time of the survey, the project was in the late construction phase of the reinforced concrete construction activities and in the early construction phase of the technical equipment- and interior work. The detailed design was not finished for all disciplines because not all areas were already rent and the final use could not be defined. The LPS has been implemented for about four months and the current PPC was 83%.

Figure 2 shows that the clan- and the market sectors are evenly divided. The hierarchy sector is medium ranked. Only the adhocracy quadrant shows with lower than average (16 points).

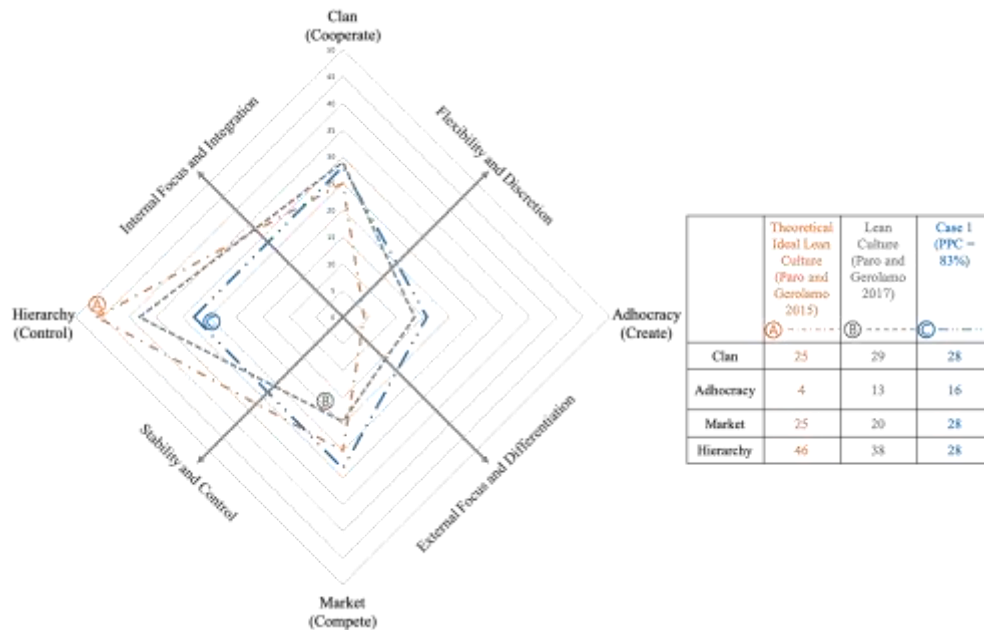


Figure 2 - CVF Case 1

The hierarchy quadrant is less pronounced as the two Ideal Lean Cultures. Accordingly, the actual PTC is not focused on standards and rules as desired by the two studies from Paro and Gerolamo (2015, 2017). The opposing adhocracy quadrant is rated lightly higher than the Ideal Lean Culture would be according to the Brazilian experts, but much higher than the theoretical perception of Paro and Gerolamo from 2015. So, the PTC is more characterized by flexible decisions, based on external influences, than desired by the TILC but comparable to the ideal culture how the Brazilian experts defined it. The uncertainty about the final design of the project and continuous planning changes could be named as reasons for this perception (which is according to Verein Deutscher Ingenieure (2017) typical for construction projects). The Clan quadrant is nearly similar to the two Ideal Lean Cultures. Interviews have shown that the participants see the LPS as a team building activity and that it has increased the feeling of trust, especially within the joint venture in comparison to the early project phases, where the LPS was not implemented. The market quadrant shows slightly higher scores than the TILC and significant higher scores than the Lean culture, ranked by the Brazilian experts. These high scores from Case 1 are even more remarkable because the two Ideal Lean Cultures were defined for organizations that need to pay attention to the competition whereby the project team could focus on the construction project.

Some weeks after the survey was conducted, however, the investor had decided that he and his specialist planners would not participate at the LPS anymore. His explanation was that the participation was no longer necessary. The joint venture's interpretation of this decision hints at contractual reasons due to unclearness of the later use, hence tactically motivating the non-participation at the LPS meetings. This change affected the PTC noticeably.



## CASE 2

Case 2 is a construction project, which is still in its design and engineering phase. The participants in the LPS meetings are the investor, various specialist planners and the design manager of the general contractor. The system has been implemented about three months and the current PPC is 51%, which is relatively low compared to the other data from the literature. Four of the specialist planners from different companies participated in the survey to measure the PTC.

Figure 3 shows that the PTC is particularly characterized by high numbers on the stability and control side of the framework. The PTC's hierarchy score is between the two studies from Paro and Gerolamo. It is accordingly characterized by clear “work standards, rules and procedures” (Paro and Gerolamo 2015). The adhocracy quadrant has comparable scores as the Ideal Lean culture from the study from 2017 but higher scores than the TILC from 2015. Accordingly, it is characterized by behaviours that the practitioners view as ideal.

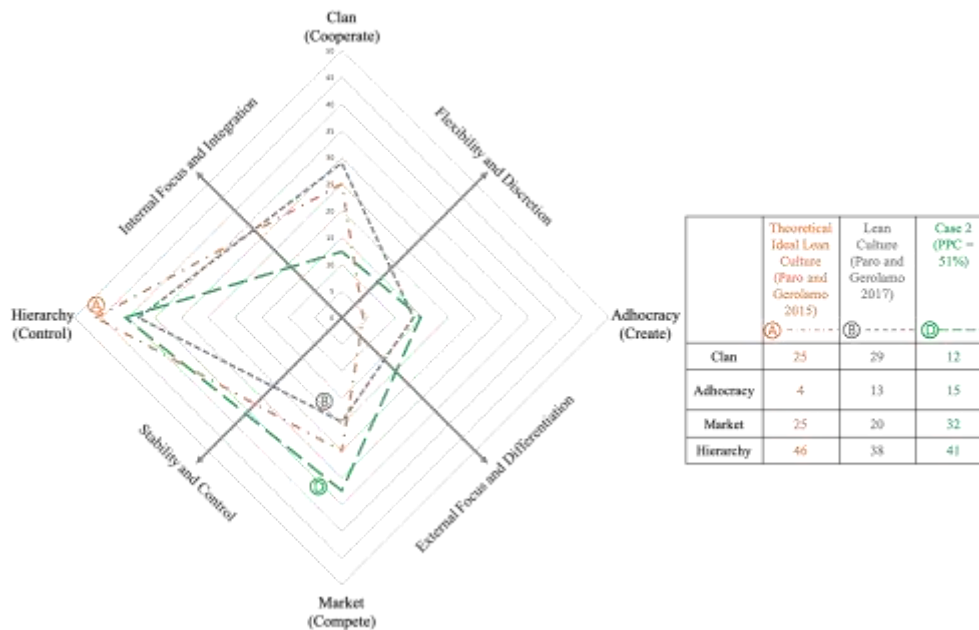


Figure 3 - CVF of Case 2

The PTC's market quadrant has striking high scores, which are higher than the TILC but much higher than the study estimation of the Brazilian experts. The focus of the project team is especially on external influences. This fits also to the low scores of the opposing clan quadrant, which differs most conspicuous in comparison to the two Ideal Lean Cultures. The distribution of the market- and the clan quadrant present the same as observations from the LPS meetings and the arrangements outside the meetings – a lack of collaboration between the various stakeholders and an assumed focus on other projects than on this case. As the collaboration is the main idea of the LPS to improve the cooperation between all parties, the low PPC is not surprising.

### CASE 3

Case 3 is a construction project in its early construction phase. The current activities are formwork-, reinforcement and concrete activities. The participants in the LPS meetings are the general contractor’s foremen, one senior site manager and one junior site manager. These three persons participated in the survey to measure the PTC. The system was especially implemented at this early stage because the team members did not know each other before and have significantly different pools of experiences. The system has been implemented for about three months before the survey. The PPC is 71% and accordingly better than at conventional construction projects, but slightly worse than common LPS projects as described in the literature.

Figure 4 shows that the distribution between the clan- and the market quadrant are balanced and as desired by the TILC whilst the market quadrant is higher than desired by the Brazilian experts. This is once again striking because of the focus on external influences instead of the focus on the single project. Furthermore, the measured PTC shows a hierarchy quadrant, which is lower than the characteristics of the two Ideal Lean Cultures. The Adhocracy quadrant is comparable to the Ideal Lean Culture from 2017 but much higher than the TICL.

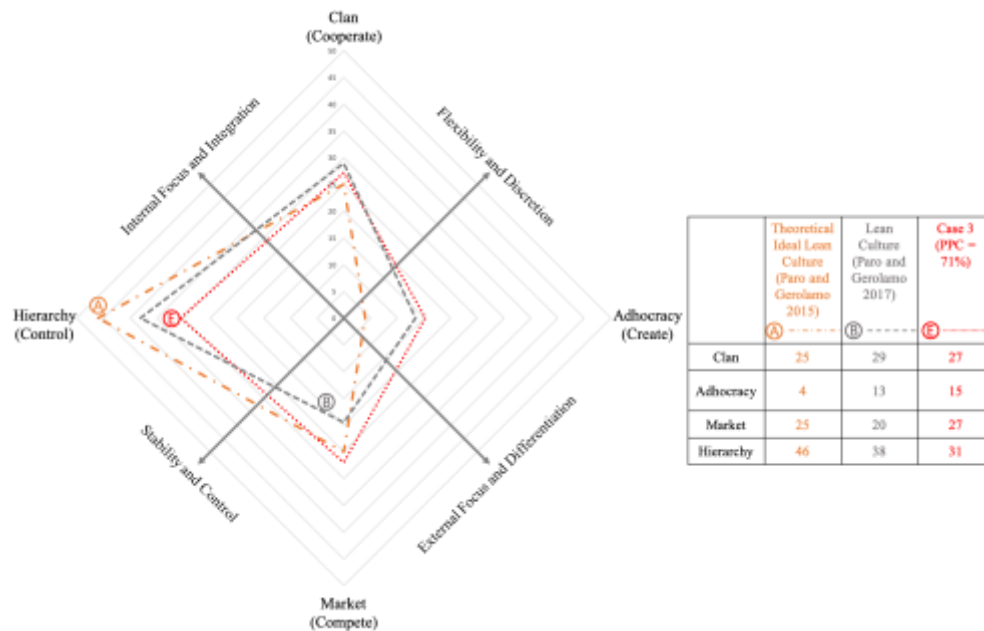


Figure 4 - CVF of Case 3

The design at this project is finished but the project team adjusts relatively often the sequence of the building activities, what could explain the low scores of the hierarchy quadrant. Another reason for the low PPC and adjustments might be that the real “Last-Planner” from the producing organization is not participating at the meetings for different reasons and that the advantages cannot be gained to reach a higher PPC. Despite the relatively low PPC scores, the project team describe the LPS as very helpful and team forming.

## COMPARING THE THREE CASES AND THE IDEAL LEAN CULTURES

Figure 5 shows the TILC according to Paro and Gerolamo (2015), the Lean Culture according to Paro and Gerolamo (2017) and the PTC's of the three case studies. It is striking that the PTC's shape of Case 1 with a PPC of 83% is nearly similar to the PTC's shape of Case 3 with a PPC of 71%. The PTC's shape of Case 3 with a low PPC of 51% differs considerably to the other two cases.

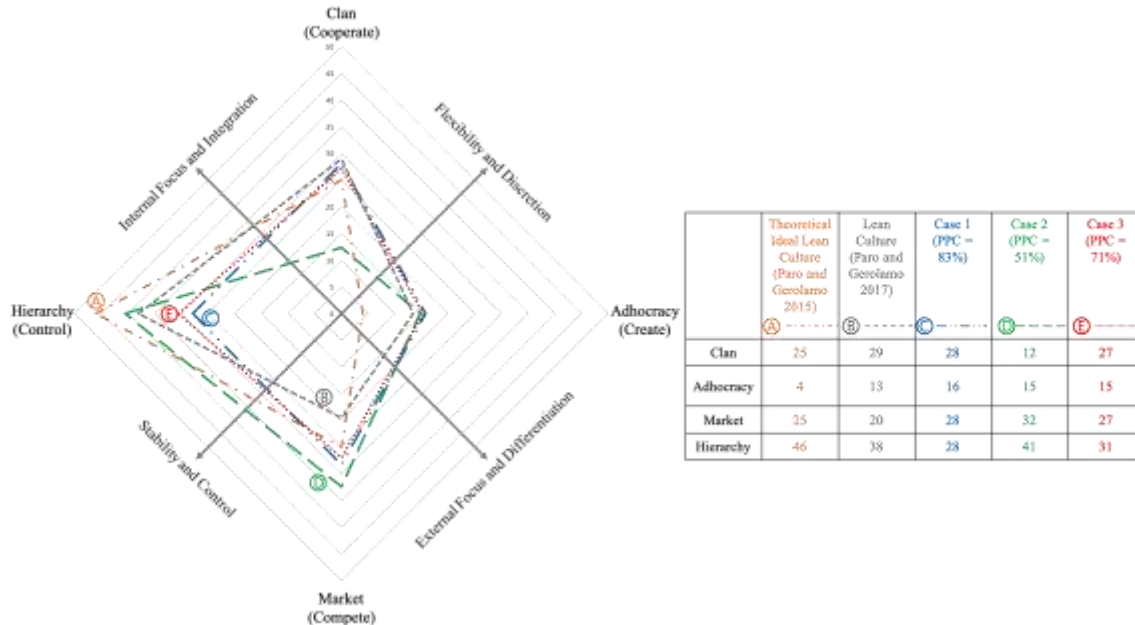


Figure 5 - Comparison of the Ideal Lean Cultures and the three case studies

The adhocracy quadrant is at all three cases and the Lean Culture from the Brazilian practitioners nearly the same but differs in comparison to the TILC. This could mean that the TILC focuses too much on rules and standards and procedures and is not interpreted practically, as the case studies confirm the estimations of the Lean experts from the survey of Paro and Gerolamo (2017).

On the other hand, it could be argued that with the highest PPC score of 83%, the optimum is not reached in any of the cases and that if the behaviours would be even more strictly fulfilled and the adhocracy behaviour would be less pronounced, the PPC could be improved. Indeed the opposing hierarchy quadrant shows that the PTCs of Case 1 and Case 3 with relatively good PPC scores are very similar but lower than the TILC or the Lean Culture. Especially Case 2 with the lowest PPC scores has the highest scores of all cases in this quadrant, between the TILC and the Lean Culture. It can be suggested that a partial focus on hierarchical characteristics is not a guarantee for project success. Rather, the clan quadrant seems to be relevant. The relatively successful projects case 1 and 3 correspondent in this quadrant with the TICL and the Lean Culture whereas the scores of Case 2 are much lower.

All three cases show higher scores in the market quadrant than intended by the two Ideal Lean Cultures. This is striking because of the focus from this paper on construction projects instead of organizations. The authors assumed that the focus would be more on internal project issues than on the market due to the lower relevance of market changes or competition within the project work.

The similar shapes of the relatively successful LPS projects and the distinctive shape of the less successful LPS project let conclude that there is a relation between the PTC and the project's success under the LPS success definition. As this paper is limited to three cases, further research should be conducted to investigate this relation. This could also lead to an adjusted shape of the Ideal LPS' PTC.

## CONCLUSION

The aim of this paper was to investigate if the CVF is a suitable tool to measure the PTC in LPS projects and if the comparison of the PTC and the defined Ideal Lean Cultures can give a statement about the project teams' maturity in relation to the LPS success definition. It has shown at three cases studies that the CVF survey is a suitable tool to measure and visualize the PTC and that there is a relation between it and the PPC, so success of the LPS.

This paper could only show snapshots of the three PTC's and as "collaboration is a fluid concept that emerges from individual and organizational interactions" (Suprpto 2016, p. V), the measurement of the PTC can only be used for the current status quo. Especially Case 1 has shown that the PTC is continuously developing and that the LPS is only a method to enable best project performances when all participating parties define these equally and as long as they want to collaborate. So a CVF should be done regularly to investigate how PTC's evolve over time and how external or internal influences affect it.

## RECOMMENDATIONS

The correlation of the scores in the CVF and the PTC scores of should be investigated. This leads to recommendations on how to improve the PTC and thereby the project success under the aspects of collaboration. Furthermore, the case studies have shown that the assumption of a pronounced clan focus instead of the focus on the market due to the project particularities was not confirmed by this study. The reasons must be investigated in further researches.

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