

# **DEFINING COOPERATION AND COLLABORATION IN THE CONTEXT OF LEAN CONSTRUCTION**

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## **ABSTRACT**

The Lean Construction approach is based on cooperation and collaboration. A review of Lean Construction literature reveals that authors use at least one or even both words without distinguishing between them, but rather use these words as synonyms. This is problematic, since a different understanding of words may lead to a misunderstanding of project issues. Therefore, clear and unified definitions are needed for both terms, thereby allowing readers and project partners, respectively, to have the same understanding of cooperation and collaboration. This paper explains the difference and defines the terms cooperation and collaboration in the context of Lean Construction projects.

## **KEYWORDS**

Collaboration, cooperation, definition, Lean Construction.

## **INTRODUCTION**

Fragmentation of the supply chain, a large number of SME, disparate management processes, non-standardized information, separation of design and construction, design-bid-build tendering, price selection, and transactional contracts (Lahdenperä 2011, Schöttle and Gehbauer 2013, Fulford and Standing 2014) are characteristics of the construction industry which have a negative effect on a project's success. To remedy the situation, the solution calls for the words cooperation and collaboration. But what is the meaning of these words?

Collaboration and cooperation are often used as synonyms in Lean Construction literature. Polenske (2004) reasoned that the similarities between cooperation and collaboration lead to the interchangeable use of the concepts. Both concepts occur between different organizations and are often adapted to increase the competitiveness of an organization. By analyzing 40 papers of the time period 2002-2012, which have the key words collaboration or partner, incentive, and construction in title or abstract, Sampaio de Melo et al. (2013) found out that there exists "no consensus in the

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construction research [...] what collaboration really means”. Also, the Oxford dictionary (2014) explains both words with the same meaning “working together”. This paper explores the differences between cooperation and collaboration to give an understanding of the meaning of the terms and to answer the question of which term should be used in the context of Lean Construction. Therefore, different definitions of the terms, cooperation and collaboration, will be presented based on different perspectives. The findings will answer the question of why participants of a Lean Construction project need the concept collaboration.

## RESEARCH METHOD

To clarify the difference between cooperation and collaboration 28 papers, published during the period of 1977 to 2014, are analyzed, focusing especially on the term collaboration. The literature search was conducted by combinations of the terms ‘cooperation’, ‘collaboration’, ‘Lean Construction’, ‘project management’, and ‘construction project’ on the research platforms Web of Science and EBSCO. Relevant papers were identified by reviewing abstract and conclusion. Additionally, references of the relevant papers were searched for further literature. Figure 1 illustrates the reviewed papers along a time scale. This literature was reviewed thematically and in chronological order. Characteristics of the terms are identified and presented in a table to compare cooperation and collaboration in detail. Based on these findings both terms are defined and exemplified in the context of Lean Construction.

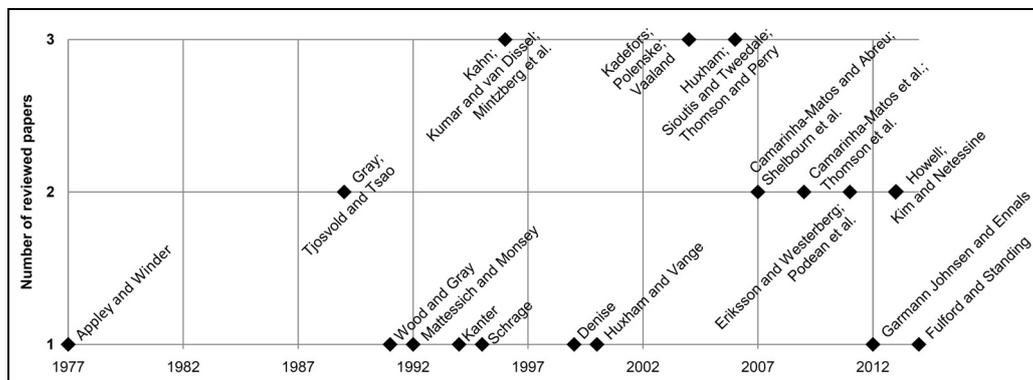


Figure 1: Mapping reviewed papers per year along a time scale

## DEFINITIONS OF THE TERMS COOPERATION AND COLLABORATION

Generally, publications in the Lean Construction literature use the terms cooperation and collaboration synonymously. One reason could be that there exists a variety of definitions for the terms cooperation and collaboration, which makes a clear differentiation problematic. Therefore, this section provides a brief overview of existing definitions.

Appley and Winder (1977) describe collaboration as a value system. They define the term as a “relational system in which: 1) individuals in a group share mutual aspirations and a common conceptual framework; 2) the interactions among individuals are characterized by “justice as fairness”; and 3) these aspirations and conceptualizations are characterized by each individual's consciousness of his/her

motives toward the other; by caring or concern for the other; and by commitment to work with the other over time provided that this commitment is a matter of choice.” Without distinguishing between cooperation and collaboration Tjosvold and Tsao (1989) point out that “in cooperation, people believe their goals are positively linked; one's goal attainment helps others reach their goals.”

In 1992, Mattessich and Monsey reviewed 18 studies over the period from 1975-1991 to answer the question: Which factors influence the success of collaboration? All in all, they found 19 factors classified into the six groups: environment, membership, process/structure, communication, purpose, and resource (see figure 2). By counting the studies to determine the most important factors, 11 studies identified mutual respect, understanding, and trust, as well as appropriate cross section of membership as factors influencing collaboration, marked with the rectangle in figure 2. Based on their findings, Mattessich and Monsey (1992) define cooperation as “informal relationships that exist without any commonly defined mission, structure or planning effort[,]” meanwhile collaboration “bring[s] previously separated organizations into a new structure with full commitment to a common mission.”

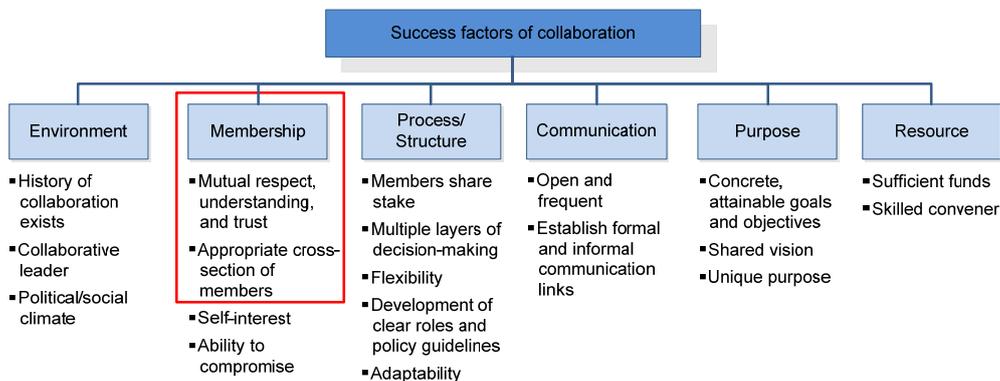


Figure 2: Success factors of collaboration (identified by Mattessich and Monsey 1992)

Schrage (1995) defines collaboration in context of value creation, as “the process of shared creation: two or more individuals with complementary skills interacting to create a shared understanding that none had previously possessed or could have come to on their own.” Here, creativity can be explained as a process to achieve innovative outcome (Podean et al. 2011). Schrage (1995) named 13 ingredients, which influence collaboration: competence; a shared understood goal; mutual respect, tolerance, and trust; creation and manipulation of shared space; multiple forms of representation; playing with the representation; continuous but not continual communication; formal and informal environments; clear lines of responsibility without restrictive boundaries; decisions do not have to be made by consensus; physical presence is not necessary; selective use of outsiders for complementary insights and information; and collaboration’s end. Like Mattessich and Monsey (1992), Schrage’s (1995) ingredients centralize the human factor. Using six semi-structure interviews and 16 questionnaires, Shelbourn et al. (2007) also ascertained that the human factor, rather than technology, is the key factor of collaboration and Kanter (1994) concludes in his paper that besides the own knowledge it is important who you know.

Four reviewed papers use the approach of “shared creation” (Denise 1999, Sioutis and Tweedale 2006, Camarinha-Matos et al. 2009, Podean et al. 2011). For example

Sioutis and Tweedale (2006) describe collaboration as “creation of dynamic links [...] without requiring a pre-defined role structure.” They argue that cooperation is more structured than collaboration. First, the roles will be defined and then the cooperators have to act in these roles. Consequently, it can be said that cooperation is less flexible than collaboration. Huxham and Vange (2000) state that changes in the structure of collaborations can be problematic, due to power differentials, and disturbed trust.

Gray (1989) defines collaboration as “a process of joint decision making among key stakeholders.” Two years later, by summarizing nine articles of a special issue of one journal, Wood and Gray (1991) define collaboration based on Gray’s (1989) definition. “Collaboration occurs when a group of autonomous stakeholders of a problem domain engage in an interactive process, using shared rules, norms, and structures, to act or decide on issues related to that domain” (Wood and Gray 1991). Furthermore, they explain that their definition is incomplete. They acknowledge that the definition does not clarify who or how many stakeholders should participate, nor do they describe organizational levels, the time horizon, or the nature of the outcome. Influenced by Wood and Gray’s (1991) definition, Thomson and Perry (2006) and Thomson et al. (2009) emphasize that collaboration emerges over time, while actors interact formally and informally with each other to create new rules and structures. Furthermore, Thomson et al. (2009) state that collaboration is multidimensional, while it’s affecting the governance, administration, mutuality, norms, and autonomy of an organization. Thus, collaborations are fragile systems as new and complex dependencies occur (Wood and Gray 1991, Kumar and van Dissel 1996, Thomson and Perry 2006, Huxham 2006). Compared to cooperation, Thomson and Perry (2006) state that collaboration “suggests a higher level of collective action than cooperation.” Kahn (1996) questioned whether the term integration is just another word for collaboration. Camarinha-Matos and Abreu’s (2007) definition of collaboration is related to a process perspective in a network. They define a collaborative process “as a set tasks performed by the collaborative network members towards the achievement of a common goal.” Vaaland (2004) asserts that collaboration itself is the critical success factor of construction projects. Eriksson and Westerberg (2011) argue that collaboration is not the criteria of project success; rather, it is a way to increase the understanding between cooperative procurement procedures and project performance. We agree with both and argue that every interorganizational relationship defines the manner in which participants interact and perform in a project and therefore is critical for the project success.

Howell (2013) questions what the balance between cooperation and competition in a project team with different participants looks like and Denise (1999) notes that, in cooperation, not every participant performs best. Moreover, the author mentioned that cooperation is a strategy about gaining a competitive advantage. Polenske (2004) likewise sees a high dependency between cooperation and competition, and asserts that in some cases cooperation and collaboration can be almost the same. This leads to the statement that collaboration and competition can also be close to each other. This link is also indicated by Garmann Johnsen and Ennals (2012). Kim and Netessine’s (2013) practical view of supply chain collaboration can be seen as a link between collaboration and competition. They develop a game-theoretical model “to balance the benefits of collaboration with the need to protect proprietary information.” But, a definition of collaboration is notably absent from the paper.

In summary, scholars agree that collaboration is temporary (Schrage 1995, Mintzberg et al. 1996, Kumar and van Dissel 1996, Denise 1999, Polenske 2004, Sioutis and Tweedale 2006, Garmann Johnsen and Ennals 2012) and if the goal is achieved, the collaboration ends. Furthermore, some of the studies explain the difference between cooperation and collaboration using a continuum of integration, commitment, and complexity in which collaboration will be the one end with a high level of integration, commitment, and complexity and cooperation the other end with a low level of integration, commitment, and complexity (Thomson and Perry 2006, Mattessich and Monsey 1992).

## COMPARING COOPERATION AND COLLABORATION

From the examined literature, 21 characteristics were identified which help to distinguish, in detail, between the terms cooperation and collaboration theoretically. Table 1 presents the findings which are often not easy to achieve in practice. It is quite evident that the different authors define the terms cooperation and collaboration on the basis of different perspectives, reflected by different characteristics.

Table 1: Comparison of the terms cooperation and collaboration

Characteristics	Cooperation	Collaboration
Authority	Retained by each organization <i>Mattessich and Monsey (1992)</i>	Determined by new structure <i>Mattessich and Monsey (1992)</i>
Contract		Incomplete <i>Garmann Johnsen and Ennals (2012)</i>
Control	Central <i>Mattessich and Monsey (1992)</i>	Shared and mutual <i>Mattessich and Monsey (1992)</i>
Cost affection	Lower transaction costs <i>Polenske (2004)</i>	Lower adaptation costs <i>Polenske (2004)</i>
Decision-making		Participative <i>Appley and Winder (1977)</i> Jointly <i>Gray (1989)</i>
Economies of scale	External <i>Polenske (2004)</i>	Internal <i>Polenske (2004)</i>
Information	Exchanging as needed <i>Mattessich and Monsey (1992)</i>	Key <i>Mattessich and Monsey (1992)</i> Shared <i>Camarinha-Matos et al. (2009), Denise (1999)</i> Using <i>Garmann Johnsen and Ennals (2012)</i>
Leadership	Unilateral <i>Mattessich and Monsey (1992)</i>	Dispersed <i>Mattessich and Monsey (1992)</i> Supportive <i>Schrage (1995)</i>
Organization	Separately <i>Mattessich and Monsey (1992)</i>	New and jointly developed <i>Mattessich and Monsey (1992)</i>
Planning	Not jointly <i>Mattessich and Monsey (1992)</i>	More comprehensive <i>Mattessich and Monsey (1992), Camarinha-Matos et al. 2009</i>
Problem solving		Together <i>Garmann Johnsen and Ennals (2012)</i>
Processes		Clearly defined <i>Shelbourn et al. (2007)</i> Interactive <i>Wood and Grey (1991)</i>
Relationship	Informal <i>Mattessich and Monsey (1992)</i>	Informal and formal <i>Mattessich and Monsey (1992), Thomson and Perry (2006), Thomson et al. (2009)</i>
Resources	Separated <i>Mattessich and Monsey (1992)</i>	Pooled and shared <i>Mattessich and Monsey (1992), Kahn (1996), Camarinha-Matos et al. (2009), Garmann Johnsen and Ennals (2012)</i>
Responsibility		Shared <i>Camarinha-Matos and Abreu (2007), Camarinha-Matos et al. (2009)</i>
Rewards	Separate	Shared <i>Mattessich and Monsey (1992),</i>

Risk	<i>Mattessich and Monsey (1992)</i> Virtually no risk <i>Mattessich and Monsey (1992)</i>	<i>Camarinha-Matos and Abreu (2007)</i> Pooled and shared <i>Mattessich and Monsey (1992), Kumar and van Dissel (1996), Camarinha-Matos and Abreu (2007)</i>
Structures	Less flexible <i>Podean et al. (2011)</i> not commonly defined <i>Mattessich and Monsey (1992)</i>	New and clearly defined <i>Mattessich and Monsey (1992), Thomson et al. (2009)</i> Jointly developed <i>Kahn (1996)</i> Shared <i>Wood and Grey (1991)</i>
Trust	Not necessary <i>Kadefors (2004)</i>	Necessary <i>Huxham and Vange (2000), Kadefors (2004), Camarinha-Matos et al. (2009), Eriksson and Westerberg (2011), Garmann Johnsen and Ennals (2012), Fulford and Standing (2014)</i>
Value generation	By various participants <i>Denise (1999)</i>	Jointly <i>Denise (1999), Camarinha-Matos et al. (2009)</i>
Vision (goal/aim/mission)	Independent <i>Mattessich and Monsey (1992)</i>	Common <i>Mattessich and Monsey (1992), Appley and Winder (1977), Kahn (1996), Huxham and Vange (2000), Huxham (2006), Camarinha-Matos and Abreu (2007), Camarinha-Matos et al. (2009), Garmann Johnsen and Ennals (2012)</i>

Concentrating on some presented characteristics and resulting aspects of table 1, figure 3 illustrates how different collaboration and cooperation assess different factors in contrast to autonomy. The terms range from very low, low, high to very high. The further a point is situated from the center, the more important it is for the relationship. It has to be stated that figure 3 shows the tendency based on the findings of the literature. Empirical data is necessary to prove the findings.

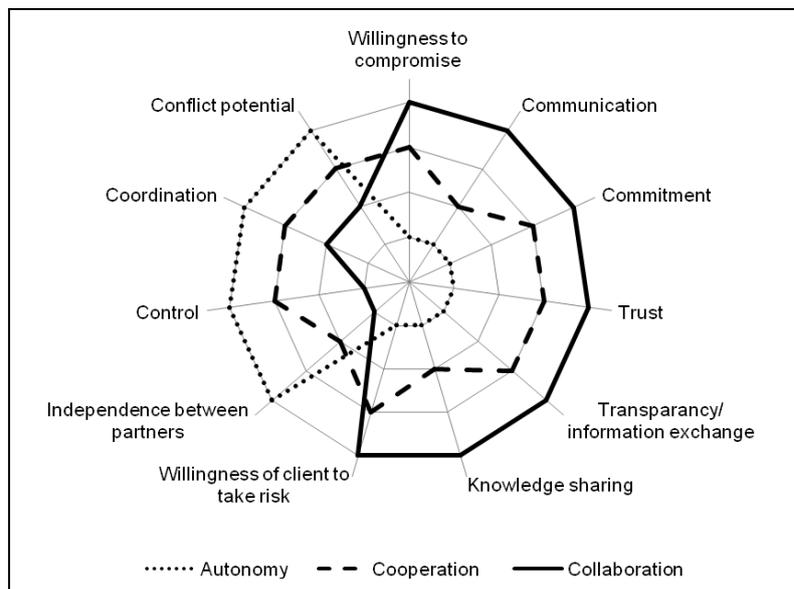


Figure 3: Compromise the terms cooperation and collaboration

It is obvious that collaboration is strongly correlated to the “soft” characteristics. Trust, communication, commitment, knowledge sharing, and information exchange are strong factors in collaboration. Participants of a collaboration act with high transparency. Cooperation is the middle ground between autonomy and collaboration, sometimes with a higher tendency to autonomy and sometimes to collaboration. Therefore, we define the terms cooperation and collaboration as follows:

- **Collaboration** is an interorganizational relationship with a common vision to create a common project organization with a commonly defined structure and a new and jointly developed project culture, based on trust and transparency; with the goal to jointly maximize the value for the customer by solving problems mutually through interactive processes, which are planned together, and by sharing responsibilities, risk, and rewards among the key participants.
- **Cooperation** is an interorganizational relationship among participants of a project, which are not commonly related by vision or mission, resulting in separated project organization with an independent structures, where the project culture is based on control and coordination to solve problems independently in order to maximize the value of the own organization.

Both terms require a shared understanding that participants are unable to achieve the project goals on their own. As stated above, soft factors have a strong impact on collaboration. This shows that collaboration does not exist automatically from the beginning of a project. Collaboration requires a process of development. Therefore, practitioners need to keep in mind that problems may occur and mistakes will be made during the phase of creating.

## **COOPERATION AND COLLABORATION IN CONTEXT TO LEAN CONSTRUCTION**

This section will transfer the definitions of cooperation and collaboration to Lean Construction theory. Figure 4 presents the linkage between the words collaboration, cooperation, coordination, conflict, communication, creation, competition, control, commitment, contract, compromise, and culture. As all 12 words start with the letter “C”, we will call this the “12 C”. We classify culture, contract, and control as parts of the other 9 C’s.

The cultural category includes the contract and control categories. This means that the cultural impact will be reflected in contracts and processes of control as they are highly influenced by an organization. The contract category has an impact on control. For example, a transactional contract focuses on control like the fulfilment of the contractual commitment; compared to a relational contract like Integrated Form of Agreement (IFOA) were people focus on trust, agreements, and commitment. Contracts frame the transactions and relations and therefore imply control. A fixed deadline is an example. Furthermore, figure 4 illustrates that culture has an impact on all 11 points and therefore frames the interaction of participants. Denise (1999) stated that cooperation, coordination, and communication have a high affinity to control. We agree with the statement, as can be seen in figure 4. In any construction project, participants are involved through three types of culture: the project culture, the culture of the organization the participants are working for, and the own cultural background of the individual. These three types of culture influence every single process in a construction project and therefore every single level of interaction. Besides the cultural element, the interaction of a team depends on coordination and communication. Kahn’s (1996) point of view is reversed. He stated that cooperation and collaboration affect the project culture. The circle closes; it is becoming clear that the linkages have a high dependency on each other. Some authors (e.g. Mattessich and Monsey 1992) define coordination as a relationship between cooperation and

collaboration. We define coordination as the planning or organization of different process activities, where two or more parties are involved, whereas cooperation and collaboration explain how participants interact. Therefore, we argue that coordination is not a separate relationship; it is part of cooperation and collaboration.

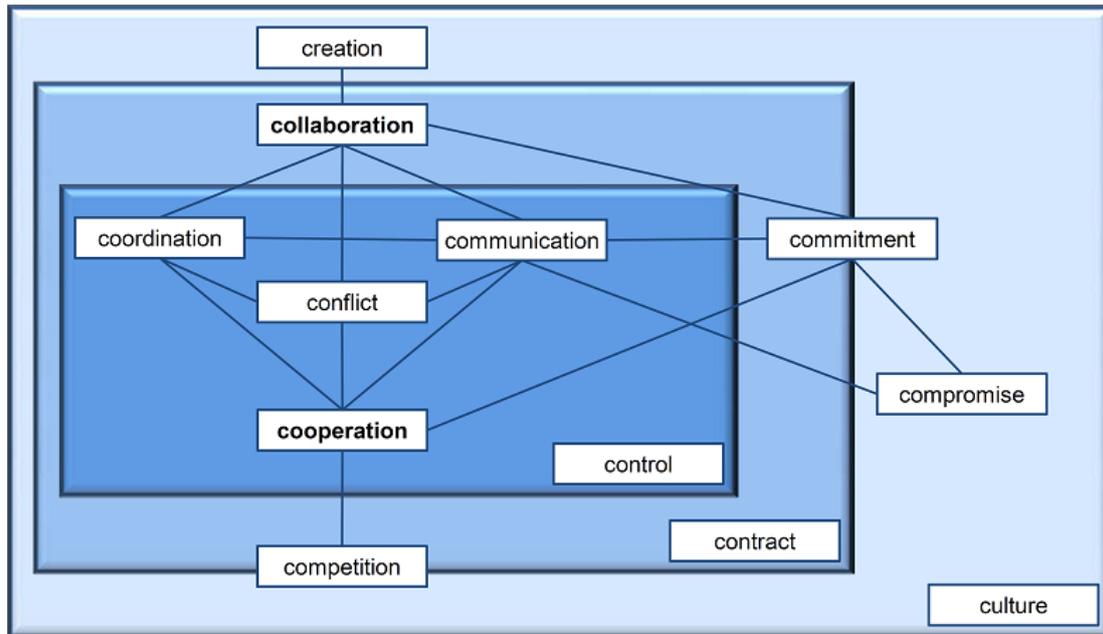


Figure 4: The 12 “C” of a construction project

Kumar and van Dissel (1996) assume that an increased degree of independence increases the potential of conflict, resulting in the need of coordination. Based on this assumption cooperations have greater conflict potential than collaborations, since the level of independence in cooperations is higher than in collaborations.

We argue that the main difference between cooperation and collaboration is the level of integration of the participants and the cultural continuum with trust on the one hand and total control on the other hand. Cooperation has a higher affinity to control, since collaboration is strongly related to trust (Kadefors 2004). Thus, collaboration is more strongly related to the cultural factor framed by relational contracts. Participants of collaboration know that not everything remedied by contract. They know that the human factor is the key for the project success. Furthermore, communication, including compromising and making commitments, is very important in this case. Participants entering into cooperations also know that they will not succeed without a partner, but their approach often aims to gain a competitive advantage for their own business. In collaboration exists competition too, but the competition exists in the environment and not in the collaboration itself. Self-interest also exists in collaborations, and as Appley and Winder (1977) say this “must be seen in relationship to the forces of caring and commitment.” These are important elements, otherwise collaborations could not be transparent and information would not be exchanged and used among participants. Consequently, there are differences in the way participants interact. This leads to the question of, when collaboration in Lean Construction projects is necessary.

## **LEAN PRINCIPLES**

One of the Lean Construction principles is value maximization for the customer. Collaboration also focuses on customer value (e.g. Schrage 1995). Cooperation is more related to individual value, which does not automatically imply the value of the customer. Another principal of Lean Construction is reducing waste. This can be reached by any interorganizational relationship, but the degree of realization can be different. For example collaboration prevents duplicity of work according to prior agreements and transparency. Additionally, the standardization of processes, continuous improvement, and learning requires trust, open access to information, experience, and knowledge sharing. This leads to the statement that the implementation of Lean principles is more likely to be successful in a collaborative environment compared to a cooperative environment.

## **LEAN TOOLS**

Two important tools in context to Lean Construction are the Last Planner System (LPS) and Building Information Modelling (BIM). Behind the tools, approaches exist to coordinate the project organization and help the team members to work together.

BIM is often described as method supporting collaboration. Fulford and Standing (2014) state that information technology is a key enabler for integration. Thomson and Perry (2006) argue that information sharing will not lead to collaboration without joint benefit. Ashcraft (2008) describes BIM as a platform for collaboration. We argue that using BIM requires collaboration as it needs transparency of all design and building processes of a project as all information is in one model. In contrast, the LPS can be applied easily to cooperative projects, but the benefits will be greater in collaborations as the LPS is not only a planning tool, but it is also a communication and coordination tool, a system of production control (Macomber and Howell 2003). In a LPS meeting, participants communicate to develop a network of commitments, which result in reliable promises the different participants make in front of the whole team. The promises will be transparently assessed in the next meeting by asking if the promise has been kept or not. Furthermore, essential of the conversation is the possibility for the participants to say “no”. Total transparency and a common project culture are not absolutely essential to exchange information and discuss problems, but they impact the degree and therefore the quality of commitments. In an open and trustful environment which exists in collaboration, the social pressure to keep the promise will be stronger than in cooperation as the participants have only a common strategy. In cooperations, the participants remain separated due to their organizations therefore it will be easier to neglect a promise if it is beneficial for their organization. This, in fact, affects the relationship and can destroy trust between project participants.

Another important tool in Lean Construction, which is also part of the LPS, is the “5 Whys”. As mentioned above, communication is important. The “5 Whys” help to find the root cause of a problem. Here it becomes obvious that, in collaboration, the reason will be easily found as it requires open communication. In cooperation, asking about the fourth or fifth “Why” is often futile, as the tendency to blame a party is higher and participants do not want to lose face.

## LEAN ORGANIZATION

Regarding the fact that a project is a “network of commitments” (Florence 1982 quoted by Macomber and Howell 2003 and Silvon et al. 2010) each member of the network brings his corporate culture to the project (Huxham and Vange 2000, Schöttle and Gehbauer 2012). The integration of team members requires the conformance of the corporate culture with the collaborative culture of the project. Thus, before collaboration can be developed, cultural integration (Kanter 1994) is necessary. Lahdenperä (2011) compares the project delivery forms called project partnering (PP), project alliancing (PA), and integrated project delivery (IPD). Based on a literature review, he concludes that PA is a form of collaboration, IPD supports collaboration, and project partnership is a non-binding collaboration. Becerik-Gerber (2010) states “like project alliancing, IPD attempts to create the collaborative atmosphere.” Another important point of the Lean organization is leadership. Schrage (1995) argues that the creation of a shared understanding is more than exchanging information. We agree with Schrage (1995) that leadership in collaboration needs to change from directive to supportive to foster the common goal. In cooperation, leadership is limited by organizational boundaries and by the contractual arrangement of the project. Leadership in cooperation is more strongly related to control than in collaboration, since the project goal is different in each organization. Furthermore, to shift responsibilities from the leader to the Last Planner and the acceptance of a better solution as the own, learning from others, as well as working for the overall project goal, requires self-reflection and trust, otherwise the leader will stick to his decisions, rather than acting in the best interest of the for project.

Lean project delivery calls for collaboration at least in the core team, consisting of owner, architect, and general contractor. Furthermore, the core team should be collaborating with the integrated project delivery team or at least with key contractors and consultancies.

## CONCLUSION

It is important to clearly distinguish between the terms cooperation and collaboration as a misunderstanding could create confusion on projects. Based on a literature review, this paper defines and describes cooperation and collaboration. It can be stated that the relationship between participants is more intense and stronger in collaboration than in cooperation, because a common goal and a jointly developed project culture on the basis of trust and transparency exist. According to Schrage (1995) it can be said that not all “professional situations require collaboration,” but as explained in this paper Lean Construction calls for collaboration at least among the key participants. For example, cooperation could be the better option for the interorganizational relationship between a sub-subcontractor and a subcontractor, whereas collaboration between the subcontractor and the general contractor could be preferred. Therefore, while developing a project team, participants and especially the client need to address the question of which kind of relationship leads to the achievement of project goals. This paper supports the decision to be made by clarifying the implications of cooperation and collaboration.

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