

Collaboration between Subsidiaries with Different Disciplines in the Construction Industry

Brinkman, Jara; Hertogh, Marcel; Bosch-Rekvelde, Marian; Rook, L.

DOI

[10.1016/j.sbspro.2015.06.118](https://doi.org/10.1016/j.sbspro.2015.06.118)

Publication date

2015

Document Version

Final published version

Published in

Procedia: Social and Behavioral Sciences

Citation (APA)

Brinkman, J., Hertogh, M., Bosch-Rekvelde, M., & Rook, L. (2015). Collaboration between Subsidiaries with Different Disciplines in the Construction Industry. *Procedia: Social and Behavioral Sciences*, (194), 44-54. <https://doi.org/10.1016/j.sbspro.2015.06.118>

Important note

To cite this publication, please use the final published version (if applicable). Please check the document version above.

Copyright

Other than for strictly personal use, it is not permitted to download, forward or distribute the text or part of it, without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license such as Creative Commons.

Takedown policy

Please contact us and provide details if you believe this document breaches copyrights. We will remove access to the work immediately and investigate your claim.

28th IPMA World Congress, IPMA 2014, 29 September – 1 October 2014, Rotterdam, The Netherlands

Collaboration between subsidiaries with different disciplines in the construction industry

Jara Brinkman^a, Marian Bosch-Rekvelde^{a*}, Marcel Hertogh^a, Laurens Rook^b

^a*Delft University of Technology, Infrastructure Design and Management, Stevinweg 1, Delft, The Netherlands*

^b*Delft University of Technology, Technology, Policy and Management, Jaffalaan 9, Delft, The Netherlands*

Abstract

Construction projects are becoming more complex and the corresponding contracts (DBFM/DBFMO) are becoming more common. These forms of contracts and the complexity of the projects require a different approach in collaboration of the parties involved. Different parties, amongst which subsidiaries, have to work together on these complex undertakings. Collaboration between subsidiaries is a subject which is not often discussed in research and this paper will provide an insight in this knowledge gap. Using a quantitative approach, this research investigated the influence of the organizational climate on the collaboration between subsidiaries working in different disciplines of the construction industry.

Based on the analysis, collaboration was operationalised in two parts: Soft Collaboration and Hard Collaboration. The independent variables posing significant effects on Soft Collaboration were Trust, Agreements and Clarity of Organizational Goals. The independent variables posing significant effects on Hard Collaboration were Trust, Agreements, Clarity of Organizational Goals and Innovation and Flexibility. When the variable of Soft Collaboration was added to the regression analysis, the significance of the independent variables changed, indicating that Soft Collaboration worked as a mediating variable.

With the results from the quantitative study, a scheme was developed to assess the current state of collaboration between subsidiaries. This scheme can be used in holding companies who are trying to improve the collaboration between subsidiaries, as a communication tool to all employees in the transition from “sentenced partnership” to “collaboration”.

© 2015 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of Scientific Committee of IPMA 2014.

Keywords: Collaboration; Trust; Organizational Climate; Subsidiaries; Agreements.

* Corresponding author. +31 15 2784771.

E-mail address: m.g.c.bosch-rekvelde@tudelft.nl

1. Introduction

In the construction industry, cooperation is a natural thing. Construction companies work together with subcontractors, clients, suppliers etc. It has become common knowledge, however, that collaboration in this sector could be improved. A special relation that is often overlooked is the working relation between subsidiaries. In the construction industry, there are a lot of companies using the subsidiary structure for the large amount of different disciplines of the construction industry (Utility, Technique, Roads, Housing, Infra, etc.). Due to the larger contracts (D&C, DBFM, DBFMO) there is earlier involvement of the disciplines in the process of building and subsidiaries are working together more closely. It is important that this collaboration is successful since the room for profit is becoming smaller, the competition is getting more severe competitive advantage is needed to win a tender.

The larger companies are nowadays strategizing to keep the collaboration in-house; between the subsidiaries, thereby enabling to jointly learn from these projects. Why is this type of collaboration different and maybe even more difficult than collaboration with outside companies? This subject was already investigated in the Health Sector (B. Hardy, Turrell, & Wistow, 1992). Their research provided a structure of problems regarding in-house collaboration. The problems can be structured in the following categories; Procedural (different planning and cycles), Structural (inter-organizational complexity), Financial (different funds), Professional (ideologies and values, professional self-interest, conflicting goals and views) and problems regarding Status and Legitimacy (organizational self-interest).

With collaboration between subsidiaries, employees seem not that considerate prior to the collaboration and think that everything will be OK, since after all they are sister companies. However, practice shows a different story. Often subsidiaries forget to make agreements about the collaboration and the intended results of the collaboration, prior to the start of the project. This and the observed difference in organizational climate (culture) between the subsidiaries led to the research question: *How does organizational climate influence collaboration between subsidiaries from different disciplines and how is this collaboration influenced by agreements?* The answer contributes to the ultimate goal of this research: to develop a policy dealing with collaboration between subsidiaries from different disciplines.

Although the separate elements of this research, collaboration, partnering, trust and organizational climate, have been researched before, this research into the combination of these constructs is new. Also no consensus exists about the exact definition of collaboration. Kolfshoten found three common ingredients of collaboration throughout literature. What differs collaboration from cooperation is that collaboration consists of joint activities (joint planning, joint creating), a specified goal towards this collaboration is directed and a common status of this goal (Kolfshoten, 2007). Kolfshoten also provided a statement of what would be good collaboration: collaboration can be called “good” when there is high group effectiveness, high group efficiency, high productivity, a commitment of resources and above all, satisfaction of the participants. After the comparison of many researches on collaboration (Hansen & Nohria, 2004; C. Hardy, Lawrence, & Grant, 2005; Hord, 1986; Kolfshoten, 2007; Meng, Sun, & Jones, 2011; Patel, Pettitt, & Wilson, 2012; Sarkar, Aulakh, & Tamer Cavusgil, 1998; Simatupang & Sridharan, 2005), this research uses the following factors that are of main importance to collaboration: *Continuous improvement, Trust, Devotion, Objective or Goal Alignment, Collaboration Support, Agreements, Communication and Compatibility.*

How does organizational climate relate to collaboration? A positive organizational climate can enhance job satisfaction, employee involvement etc. (Robbins & Judge, 2012). Fey and Beamish (2001) and Sarkar et al. (Sarkar et al., 1998) investigated the relation between a compatible organizational climate and good collaboration. They stated that compatibility in culture, process, and climate is important for the performance and continuous improvement of the collaboration, especially when the collaboration is not for one project but for a longer period of time. For this research, we hypothesized that when partners are more compatible on the area of organizational climate, the “degree of collaboration” between them will be higher.

Partnering is another aspect of the research. “*Partnering is not a contract but an attempt to establish non-adversarial working relationships among project participants through mutual commitment and open communication. It also serves to create an environment that fosters cooperation and teamwork*” (Cheung, Ng, Wong, & Suen, 2003). Partnering charts between different corporations are seen as relatively normal, whilst with working with subsidiaries, no agreements or contract previous to the collaboration are drawn. Two different approaches on how to deal with Partnering were found. On one hand, Nooteboom (1994) mentions that setting limits

on partnering could destroy the willingness to sacrifice. And on the other hand, Benett and Jayes (1998) and Cheung et al (2003) do talk about a partnering chart and how agreements made beforehand can help. Cheung et al. used a questionnaire to monitor the partnering and to discuss this in monthly meetings. This questionnaire involves all aspects most essential to partnering. It combines the hard aspects, soft aspects, the attitude oriented, performance-oriented and the process oriented items. For this research it is hypothesised that using partnering charts has a positive influence on intra organisational collaboration.

The third and final aspect of the literature research is trust. Trust is a returning factor in all theories on collaboration and partnering, so this factor deserves some extra attention, especially in the relationship with contracts and partnering. Klein Woolthuis et al. (2005) researched this relationship. Using four different case studies, they made an inventory on how trust, dependence and contract completeness related to the project outcome. They stated that contracts and trust actually complement each other and that trust is needed even prior to drawing the contract.

In an informal meeting at the holding company involved, some employees said: “*Why should we make agreements, we are sisters! We should trust each other*”. This observation, in combination with the earlier mentioned literature, led to the following three hypotheses related to trust:

- 1) trust has a negative influence on the decision to make agreements on collaboration.
- 2) trust between subsidiaries has a positive influence on collaboration in general.
- 3) the more similar the levels of organizational climate, the higher the level of trust.

2. Method & Data Measurement

After the literature research to formulate the hypotheses, empirical research was performed consisting of data collection using a survey and interviews. The object of this research is a holding company “A” and two subsidiaries: Utilities and Techniques. To gather participants for the research, unit managers and operational managers from each different regional office of the two operating companies were asked to list 10 people working together with the other subsidiary during the tender phase, and 10 random people from that office. Like the Organizational Climate Measure suggests, the managers were asked to select people with a variety in management level. The participants had to complete a web-based questionnaire which took about 30 minutes.

The final sample consisted of 276 employees distributed over 21 offices. Of these offices 11 belonged to the operation company Utilities and 10 to the operation company Techniques. The total response rate for the online survey was 62% (171 employees from 18 offices). The response rate for Utilities was 68% and for Techniques was 57%. Of these respondents, 94% was male and the average age was 44 years ($SD=9.87$). Participants were asked about their function; 24% of the participants were low in the organization, 57% in middle management and 19% was higher management.

As much as possible, the separate parts of the survey were based on earlier tested and proven questionnaires. Since these were in English and the native language of the participants was Dutch, these were translated. Translations were tested with various experts.

Collaboration. Collaboration was measured using a 4 point Likert scale (1=definitely false, 2=mostly false, 3=mostly true 4=definitely true). The method of Cheung et al. for the measurement of the collaboration in partnering was used. Collaboration was split into two components, Hard and Soft (*Hard: $M=2.72$, $SD=.50$ and Soft: $M=2.89$, $SD=.51$*). The questions concerning Soft collaboration were concerning the more human aspects of collaboration, for example: “*I feel that the working relationships between all individuals are based on honesty, openness, and integrity*”. The questions on Hard Collaboration were concerning the more defined aspects of collaboration, for example: “*I feel that my organisation is achieving reasonable commercial success from this collaboration*”.

Organizational Climate. Organizational Climate was measured using the validated Organizational Climate Measurement by Patterson et al. (2005), with a 4-point Likert scale. In total 17 sets of questions divided into four quadrants were included in the survey. The four quadrants were *Human Relations, Internal Process, Open Systems and Rational Goal*:

- 1) *Human Relations*. When performing a Principal Component factor analyses (restricted on finding 6 components) on these six variables only two of these components showed. These were the components of *Autonomy* and *Involvement*. Both components showed sufficient Crohnbachs Alpha scores (respectively .72 and .78) and thus will be involved in the further research.
- 2) *Internal Process*. When performing a Principal Component Analyses (limited on finding two components) these two components were clearly visible in the results. The Crohnbach’s Alpha on Tradition was more than sufficient (.80) but the Alpha of Formalization is actually too low (.66). This means only *Tradition* is included into further research.
- 3) *Open Systems*. For *Open Systems* only one of the components was found when executing a Principal Component analyses (fixed on finding 3 components). This was the component of *Innovation and Flexibility*. The Crohnbach’s Alpha was also sufficient (>.7). Thus, *Innovation and Flexibility* will be involved in further research.
- 4) *Rational Goal*. Again, in the Principal Component analyses (fixed on finding 6 components) only 2 components were significantly shown. These were *Clarity of Organizational Goal* (Alpha .88) and *Pressure to Produce* (Alpha .74). These two components are going to be involved in further research.

Trust. Trust was measured using a validated set of questions from the article “*The organizational Trust Inventory*” by Cummings and Bromiley (1996). They involve all the components of trust (integrity, predictability, benevolence). The 4-point Likert scale from the Organizational Climate measure was implemented into this measurement, to make the total survey as simple as possible ($M=2.90, SD=.46$).

Agreements. Agreements was measured using a set of 5 questions, asking for facts. Again, the 4-point Likert scale was used. The questions were concerning overall agreements, agreements on importance of the project, agreements on mutual goals, agreements on how to deal with contracts etc. ($M=2.88, SD=.53$).

3. Results

Data was processed using SPSS and following well known data processing handbooks (Field, 2009). First, descriptive statistics were analysed, subsequently more complex regression analyses were performed.

3.1 Descriptive Statistics

To get an indication of what we can find during a regression analysis, first a correlation matrix was calculated using the entire dataset (n=171), see

Table 1.

Table 1. Correlation Matrix.

Variable	M	SD	1	2	3	4	5	6	7	8	9	10
1 Trust	2.90	.46	-									
2 Agreements	2.88	.53	.379**	-								
3 Autonomy	2.93	.45	0.135	-0.015	-							
4 Involvement	2.85	.42	.216**	.193*	.357**	-						
5 Tradition	2.06	.56	-0.045	-.174*	-.161*	-.445**	-					
6 Innovation and Flexibility	2.71	.54	0.099	.357**	0.066	.494**	-.576**	-				
7 Clarity of Organizational Goals	2.76	.54	.171*	.197*	0.081	.559**	-.316**	.537**	-			
8 Pressure to Produce	2.68	.43	0.013	-0.006	-0.11	-0.028	-0.13	0.006	-0.036	-		
9 Collaboration_Soft	2.89	.51	.562**	.390**	0.066	.325**	-0.105	.294**	.351**	-0.126	-	
10 Collaboration_Hard	2.72	.50	.444**	.395**	-0.063	.327**	-.244**	.450**	.396**	0.021	.649**	-

** . Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

This correlation matrix shows the correlation strength including the corresponding relevance of this correlation. The most striking outcomes are briefly discussed. A definite correlation was found between *Agreements* and *Trust*. When more agreements are made, more trust can be found between the collaborating parties ($r=.379, p<0.01$). Also, climates with a high *Involvement* had positive influence on *Trust* in the other party ($r=.216, p<0.01$). *Trust* also shows to have influence on the dependent variables *Soft-* and *Hard Collaboration* ($r=.562, p<0.01$ and $r=.444, p<0.01$). Making agreements is another variable which seems to have high influence on both *Soft-*, en *Hard Collaboration* ($r=.390, p<0.01$ and $r=.395, p<0.01$).

Organizational Climate factors that show high correlations with the dependent variables are *Involvement* (*Soft*: $r=.325, p<0.01$ and *Hard*: $r=.327, p<0.01$), *Innovation and Flexibility* (*Soft*: $r=.294, p<0.01$ and *Hard*: $r=.450, p<0.01$), and *Clarity of Organizational Goals* (*Soft*: $r=.351, p<0.01$ and *Hard*: $r=.396, p<0.01$). Besides these independent variables, also the correlation between *Soft-* and *Hard Collaboration* showed to be very significant ($r=.649, p<0.01$). This could be an indication that *Soft Collaboration* could function as a mediating variable in the regression model.

3.2 Soft Collaboration

Before conducting a regression analysis, the variables were all centred, so the regression analysis would give the most consisting and valid outcomes. All outcomes of this regression analysis can be found in Table 2. The main effect of *Trust* on *Soft Collaboration* was highly significant ($\beta=.46, p<.001$). The independent variable *Agreements* showed also a significant effect ($\beta=.14, p<.053$). The last variable which showed significant influence on *Soft Collaboration* is *Clarity of Organizational Goals* ($\beta=.15, p<.050$).

Interactive Effects. The hypothesis already predicted interaction effects between *Agreements* and *Trust*, and between *Organizational Climate* and *Trust*. The regression revealed a significant linear interaction of *Agreements X Innovation and Flexibility* ($\beta=.30, p<.044$). A linear two-way interaction model was plotted and showed the relationship between these two variables. It showed that when there is a climate of low *Innovation and Flexibility*, the *Soft Collaboration* benefits from a high level of *Agreements*. The other way around, when there is a climate of high *Innovation and Flexibility*, the *Soft Collaboration* benefits from a low level of *Agreements*. Overall, *Soft Collaboration* benefits most from a High Level of *Agreements* in combination with a low level of *Innovation*. Also the combined variable of *Agreements X Innovation and Flexibility X Clarity of Organizational Goals* showed to be highly significant with $\beta=.40$ and $p<.001$. A three-way interaction between *Agreements, Innovation and Flexibility and Clarity of Organizational Goals* was found that was not already foreseen in the theoretical framework. This combination of variables indicates that there are several combinations of levels of variables which could lead to a higher or lower level of *Collaboration*. First of all, all people seem to be benefiting from a high level of trust, since the slopes of all lines are positively reacting on high *Trust* and high *Collaboration*. The combination of high *Innovation and Flexibility* and high *Clarity of Organizational Goals* seems to be the best combination for achieving high *Collaboration*. All other combinations reach in combination with high *Trust*, lower levels of *Collaboration*. The worst possible situation is when there is a climate of low *Innovation and Flexibility* and low *Clarity*. For the dependent variable of *Soft Collaboration*, the independent variable of *Clarity* seems to more important, over the independent variable of *Innovation and Flexibility* by just a bit. The two slopes are almost identical; however, a small difference puts the line of low *Innovation* and high *Clarity* at a higher starting and ending point than the line for low *Clarity* and high *Innovation*.

Table 2. Result Regression Analysis with Dependent Variable Soft Collaboration and Hard Collaboration (n= 171).

Dependent Variable	Soft	Hard
	Collaboration	Collaboration
	β	β
Step 1: Controls		
Autonomy	-0,032	-0,13
Involvement	0,109	0,08
Tradition	0,088	0,01
Pressure to Produce	-0,087	0,04
Step 2: Main Effects		
Trust	0,46***	0,34***
Agreements	0,14†	0,13†
Clarity of Organizational Goals	0,16*	0,16†
Innovations and Flexibility	0,13	0,28*
Step 3: Linear Interaction		
Agreements X Innovations and Flexibility	0,30*	-0,13
Step 4: Non-Linear Effects		
Agreements X Innovations and Flexibility X Clarity of Organizational Goals	0,40**	0,26†

† p<.10, * p<.05, ** p<.01, *** p<.001

3.3 Hard Collaboration

The variables that showed significant influence also for *Hard Collaboration* were *Trust* ($\beta=.39$, $p<.001$) and *Agreements* ($\beta=.13$, $p<.070$) and also the Organizational Climate variable *Clarity of Organizational Goals* ($\beta=.16$, $p<.057$). Additionally, *Innovation and Flexibility* ($\beta=.29$, $p<.009$) showed significant influence on *Hard Collaboration*. When the variable of *Soft Collaboration* was added to the regression analysis, the significance of the independent variables changed. *Soft Collaboration* showed highly significant ($\beta=.46$, $p<.001$).

Interactive Effects. Again, the combined variable of *Agreements X Innovation and Flexibility X Clarity of Organizational Goals* showed to be highly significant with $\beta=.39$ and $p<.002$. This three-way interaction of variables indicates that there are several combinations of levels of variables which could lead to a higher or lower level of *Collaboration*. First of all, all people seem to be benefiting from a high level of *Agreements* concerning *Hard Collaboration*, since the slope of all lines are positively reacting on high *Agreements* and high *Collaboration*. The combination of high *Innovation and Flexibility* and high *Clarity of Organizational Goals* seems to be the best combination for achieving high *Collaboration*. All other combinations reach in combination with high *Trust*, lower levels of *Collaboration*. The worst possible situation is when there is a climate of low *Innovation and Flexibility* and low *Clarity*. The level of *Agreements* also seems to have less of an influence for this situation. The difference between low *Agreements* and high *Agreements* is less definite in this climate. Also a distinction can be made between the importance of *Innovation and Flexibility* and *Clarity of Organizational Goals*. The latter seems to be less important, since the absence of high *Clarity* shows a higher level of *Collaboration* than the absence of *Innovation*.

3.4 Mediation Analyses

When conducting the regression analyses, there were some indications that variables could be working on *Hard Collaboration* through *Soft Collaboration*. Throughout the analyses two of these mediations were found.

Partial Mediation Model. A correlation between *Soft-* and *Hard Collaboration* was established during the descriptive analyses ($r=.649, p<0.01$). Also the first condition for mediation was met: a significant main effect of *Trust* on *Soft Collaboration* $\beta=.46, p<.001$. Then the second condition was met: a significant main effect of *Trust* on *Hard Collaboration* $\beta=.39, p<.001$. Adding *Soft Collaboration* to the model, it led to a drop of β size of the effect of *Trust* on *Hard Collaboration*, $\beta=.13, p<.075$ in favour of: a significant effect of *Soft Collaboration* on *Hard Collaboration*, $\beta=.44, p<.001$. A Sobel test revealed that this indirect effect was significant ($z = 2.04, p < .041$). This means that *Soft Collaboration* served as a partial mediator of the effect of *Trust* on *Hard Collaboration*. When the independent variable would have no significant influence at all after adding the mediation variable, this would mean there is full mediation.

Full Mediation Model. The correlation between *Soft-* and *Hard Collaboration* was already established during the descriptive analyses. Also the first condition for mediation was met: a significant three-way interaction of *Agreements X Innovation and Flexibility X Clarity of Organizational Goals* on *Soft Collaboration* $\beta=.40$ and $p<.001$. Then the second condition was met: a significant three-way interaction of *Agreements X Innovation and Flexibility X Clarity* on *Hard Collaboration* $\beta=-.34$ and $p<.004$. Adding *Soft Collaboration* to the model led to a drop of β size of the effect of *Agreements X Innovation and Flexibility X Clarity* on *Hard Collaboration* on *Hard Collaboration*, $\beta=.22, p<.172$ in favour of: a significant effect of *Soft Collaboration* on *Hard Collaboration*, $\beta=.44, p<.001$. A Sobel test revealed that this indirect effect was significant ($z = 1.72, p < .085$). Thus, *Soft Collaboration* served as a full mediator of the effect of *Agreements X Innovation and Flexibility X Clarity of Organizational Goals* on *Hard Collaboration*.

3.5 Collaboration Model

Summarizing the findings of the regression and mediation analyses, a model was drafted, see Fig. 1. The factors *Trust* and *Agreements X Innovation and Flexibility X Clarity of Organizational Goals* have the most significant influence on collaboration, just like the influence *Soft Collaboration* has on *Hard Collaboration*.

4. Discussion

The most important finding of this study is that Collaboration can be split up in two parts; the soft, intangible part about human interactions (communication, appreciation etc.), and the other, harder, part, about the facts, numbers and the outcome of the collaboration (reaching goals, profit etc.). The “soft part” influences the hard part of collaboration almost one on one. This is a very interesting fact to keep in mind when trying to excel in collaboration. It is also in line with previous research on negotiation techniques (Pruitt, 1983; Van de Vliet & Janssen, 2001). Furthermore this study shows that Organizational Climate factors are highly influencing the two collaboration parts.

4.1 Reviewing the hypotheses

Differences in organizational climate A lot of research has been done regarding safety and customer oriented climate, however a knowledge gap existed concerning the relation between organizational climate and collaboration (Schneider, Ehrhart, & Macey, 2013). This resulted in hypothesis H1: *When collaboration partners are more compatible (more alike) on the area of organizational climate, the degree of collaboration will be higher*. This hypothesis could neither be rejected nor accepted due to limitations of the dataset. It was shown that the differences

in organizational climate do not solely negatively or positively influence the collaboration of subsidiaries. Clarity of Organizational Goals and Innovation and Flexibility are the most important organizational factors for collaboration.

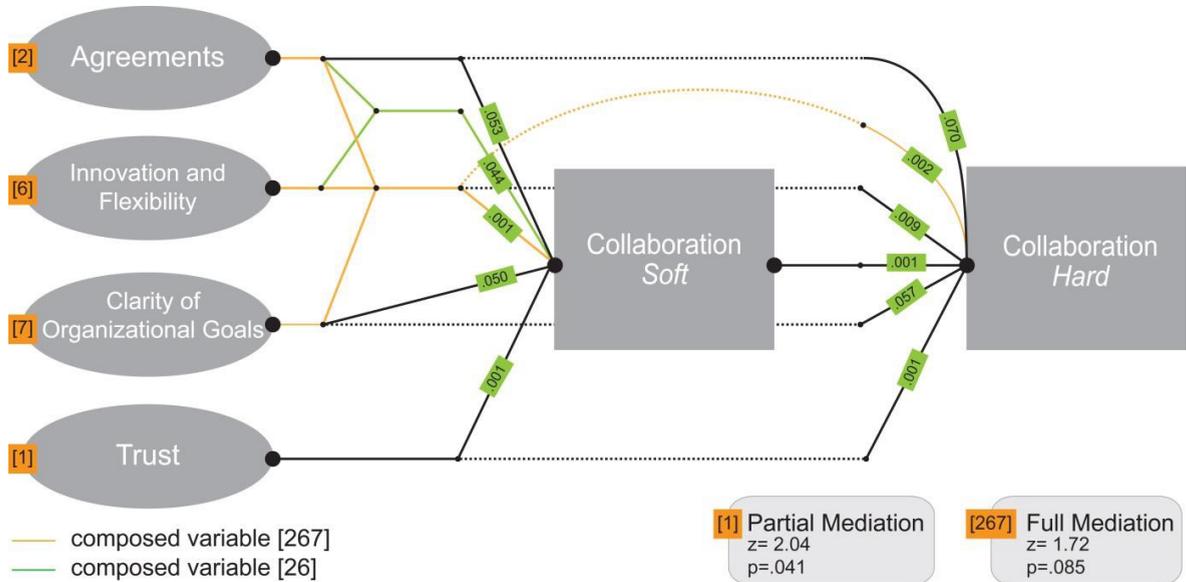


Fig. 1. Collaboration Model

Tension between Agreements and Trust Some interviews that were conducted in the beginning of the research suggested that it is expected that trust should be in place (note the word “should”), and making agreements would be a sign of disrespect. Literature also indicated that a contract and trust could be substitutes of each, other depending on the situation (Klein Woolthuis et al., 2005). The literature research concluded that making agreements on mutual objectives, communication, strategy, membership, equity, integration, project process and feedback all contribute to better collaboration. Correlation analysis shows that when looking at this particular situation, Trust and Agreements influence each other positively. Also, the regression analysis shows over and over again that making Agreements has a positive influence on collaboration. Which means that hypotheses H2: *Using Partnering Charts has a positive influence on intra organizational collaboration* is confirmed.

Agreements in combination with Clarity of Organizational Goals and Innovation and Flexibility together influence Hard Collaboration through the mediation variable Soft Collaboration. Trust has a positive influence on Collaboration and a negative influence on Agreements. From the regression analyses and subsequent interviews, it is concluded that hypothesis H3: *Trust has a negative influence on the decision to make agreements on collaboration* is rejected: trust and Agreements both positively influenced each other. The second hypothesis concerning Trust hypothesis H4: *Trust between the subsidiaries has a positive influence on collaboration in general* inevitably was confirmed. All regression analyses show the significant relation between Trust and Collaboration. This confirms earlier observations that trust is one of the main important elements of good collaboration Meng et al.(2011), Patel et al. (2012) and Sarkar et al. (1998).

Hypothesis H5: *The more similar the levels of Organizational Climate, the higher the level of Trust* could not be confirmed based on the current data. The analysis shows a positive linear relation between the numbers of differences and the level of trust, hence rejecting the hypothesis. However, the rejection of this hypothesis does not automatically mean that the opposite is true. Again, for valid conformation of this hypothesis a larger number of cases should be entered in the research.

4.2 Collaboration Model for subsidiaries with different disciplines in the construction industry

The main contribution of this research is a collaboration model for subsidiaries in the construction industry, see Figure 1. The numbers in the collaboration model are corresponding with the numbers of the correlation matrix.

Soft Collaboration: The main effects on *Soft Collaboration* are *Trust* and *Agreements*. *Trust* is in all cases the most important factor. *Agreements* also show to have a strong and significant influence. The last main effect on *Soft Collaboration* is *Clarity of Organizational Goals*. These main findings clearly indicate a positive effect of all these variables. Main effects are supplemented by interactive effects.

Interactive Effects: The regression revealed a significant linear interaction of *Agreements X Innovation and Flexibility*. It shows that when there is a climate of low *Innovation and Flexibility*, the *Soft Collaboration* benefits from a high level of *Agreements*, and the other way around; when there is a climate of high *Innovation and Flexibility*, the *Soft Collaboration* benefits from a low level of *Agreements*. Also the combined variable of *Agreements X Innovation and Flexibility X Clarity of Organizational Goals* shows to be highly significant. This three-way interaction between *Agreements*, *Innovation and Flexibility* and *Clarity of Organizational Goals* was not foreseen in the theoretical framework. First of all, all collaborations are benefiting from a high level of *Agreements*. The combination of high *Innovation and Flexibility* and high *Clarity of Organizational Goals* is the best combination for achieving high *Collaboration*. For the dependent variable of *Soft Collaboration*, the independent variable of *Clarity* is slightly more important over the independent variable of *Innovation and Flexibility*.

Hard Collaboration: The main effects of the independent variables on *Hard Collaboration* are *Trust*, *Agreements*, *Clarity of Organizational Goals* and a new one, *Innovation and Flexibility*. When the variable of *Soft Collaboration* is added to the regression analysis, the significance of the independent variables change. This indicated that *Soft Collaboration* works as a mediation variable.

Interactive Effects; Again, the combined variable of *Agreements X Innovation and Flexibility X Clarity of Organizational Goals* shows a positive and significant effect. First of all, all collaboration are benefiting from a high level of *Agreements* concerning *Hard Collaboration*. The combination of high *Innovation and Flexibility* and high *Clarity of Organizational Goals* seems to be the best combination for achieving high *Collaboration*. A difference is distinguished in the importance of *Innovation and Flexibility* and *Clarity of Organizational Goals*. *Clarity of Organizational Goals* is slightly less important than *Innovation and Flexibility*, since the absence of high *Clarity* shows a higher level of *Collaboration* than the absence of *Innovation*. This is the opposite of what is witnessed concerning *Soft Collaboration*.

Mediation Effects: Two variables are working on *Hard Collaboration* through *Soft Collaboration*; these are the variables *Trust* and *Agreements X Clarity of Organizational Goals X Innovation and Flexibility*. For *Trust* this is a partial mediation and for the combined variable, a full mediation. Partial mediation means that the variable both influences the dependent variable directly, as indirectly through the mediation variable. This is true for *Trust*.

4.3 Managerial Implications

The goal of this study was to contribute to the development of a policy dealing with collaboration between subsidiaries from different disciplines. This section introduces a roadmap based on the model that was developed (Fig. 2). Using the roadmap, the current state of the collaboration can be assessed as well as the desired state and actions can be taken to reach the desired state.

In order to change a situation, looking at organizational change and change management is a logical step. Several studies came up with steps on how to implement change (Hutton, 2000; Kotter, 1996; Robbins & Judge, 2012). A combination of these steps is suggested to follow in improving the collaboration between subsidiaries:

1. Create a sense of urgency and understanding within the subsidiaries for this change,
2. Assign key-players to lead this change on both sides of the subsidiaries,
3. Assess the current situation, determine the steps that need to be taken within the period of movement,
4. Implement the plan into the collaboration on both subsidiaries, than refreeze the situation again, until the new vision becomes the stable situation,
5. Keep monitoring the proces,
6. Start again with assessing the current situation.

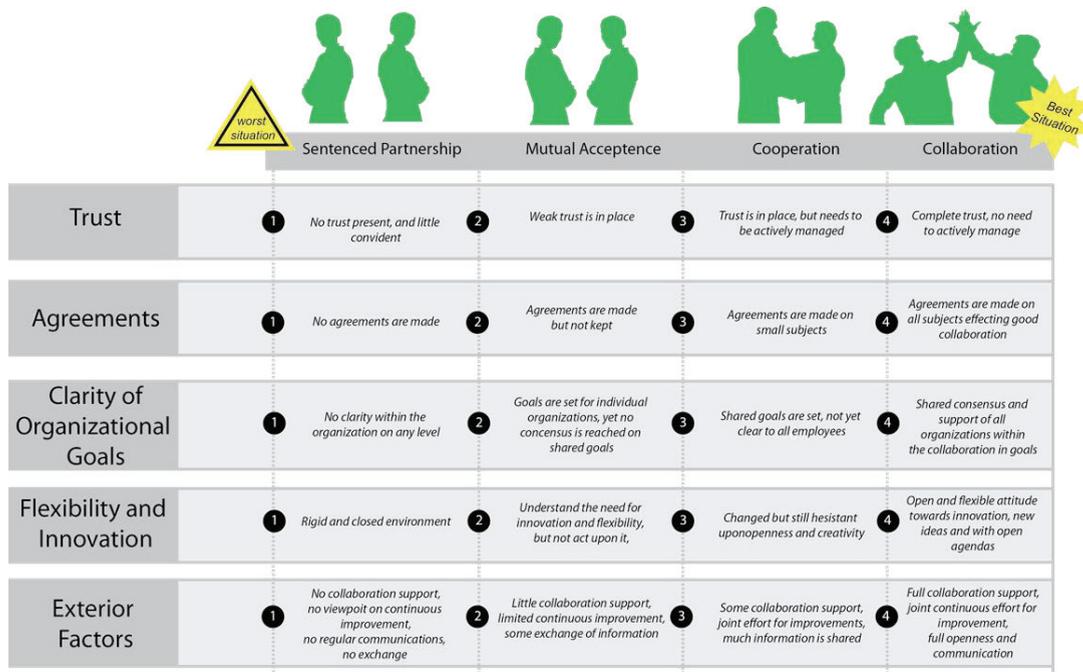


Fig. 2. Roadmap to achieve better collaboration

Trust can result from making agreements (Figure 1). Since making Agreements is easier to influence than Trust, this could be the first step to take. Trust is not something that someone can just put into place; agreements or stating the organizational goals are easier to manage. The higher the levels of all factors, the closer the collaboration. External factors (for example related to strategic decisions of the holding company) might prohibit reaching the “best situation” box (under *Collaboration* in Fig. 2) for all factors.

5. Conclusions

How does organizational climate influence collaboration between subsidiaries from different disciplines and how is this collaboration influenced by agreements? The two organizational climate factors influencing collaboration most are Clarity of Organizational Goals and Innovation and Flexibility. When these factors are strong within a subsidiary, it will benefit the collaboration. Furthermore trust remains an important factor regarding collaboration, also in reference to making agreements. It shows that trust and agreements are no substitute for each other and both need to be present in order to come to an optimal state of collaboration between subsidiaries. On of the most interesting findings of this research is that employees measure collaboration not only in the outcome of the collaboration (Hard facts), but also in the more human parts of the collaboration (Soft Collaboration). This soft collaboration is almost one on one influencing Hard Collaboration and is thus very important to keep in mind when excel in collaboration is aimed for. Using a web-based survey on the factors collaboration, trust, agreements, clarity of organizational goals and innovations and flexibility, a baseline can be drawn on the degree of collaboration. With the introduced roadmap, a strategy can be set up to come to a higher degree of collaboration.

References

- Benett, J., & Jayes, S. (1998). *The Seven Pillars of Partnering: a guide to second generation partnering*: Thomas Telford.
- Cheung, S.-o., Ng, T. S. T., Wong, S.-P., & Suen, H. C. H. (2003). Behavioral aspects in construction partnering. *International Journal of Project Management*, 21(5), 333-343.
- Fey, C. F., & Beamish, P. W. (2001). Organizational climate similarity and performance: International joint ventures in Russia. *Organizational studies*, 22(5), 853-882.
- Field, A. (2009). *Discovering Statistics Using SPSS*. London: SAGE Publications Ltd.
- Hansen, M. T., & Nohria, N. (2004). How to Build Collaborative Advantage. *MIT Sloan Management Review*, 46(1), 23-31.
- Hardy, B., Turrell, A., & Wistow, G. (1992). *Innovations in Community Care Management*. Avebury: Aldershot.
- Hardy, C., Lawrence, T. B., & Grant, D. (2005). Discourse and Collaboration: the role of conversations and collective identity. *Academy of Management Review*, 30(1), 58-77.
- Hord, S. M. (1986). A synthesis of research on organizational collaboration. *Educational Leadership*, 43(5), 22-26.
- Hutton, D. W. (2000). *From Baldrige to the Bottom Line: a road map for Organizational Change and Improvement*. Milwaukee, Wisconsin: ASQ Quality Press.
- Klein Woolthuis, R., Hillebrand, B., & Nootboom, B. (2005). Trust, Contract and Relationship Development. *Organizational studies*, 26(6), 813-840.
- Kolfschoten, G. L. (2007). *Theoretical Foundations for Collaboration Engineering*. (doctor), Delft University of Technology, Delft.
- Kotter, J. P. (1996). *Leading Change*. Boston: Harvard Business School Press.
- Meng, X., Sun, M., & Jones, M. (2011). Maturity Model for Supply Chain Relationships in Construction. *Journal of Management in Engineering*, 27(April), 97-105.
- Nootboom, B. (1994). *Management van Partnerships: in toeleveren en uitbesteden*. Schoonhoven: Academic Service.
- Patel, H., Pettitt, M., & Wilson, J. R. (2012). Factors of collaborative working: A framework for collaboration model. *Applied Ergonomics*, 43, 1-26.
- Patterson, M. G., West, M. A., Shackleton, V. J., Dawson, J. F., Lawthom, R., Maitlis, S., . . . Wallace, A. M. (2005). Validating the organizational climate measure: links to managerial practices, productivity and innovation. *Journal of Organizational Behaviour*, 26(4), 379-408.
- Pruitt, D. G. (1983). Strategic choice in negotiations. *American Behavioral Scientist*, 27(2), 167-194.
- Robbins, S. P., & Judge, T. A. (2012). *Essentials of Organizational Behaviour*. Essex: Pearson Education Limited.
- Sarkar, M., Aulakh, P. S., & Tamer Cavusgil, S. (1998). The strategic role of relational bonding in interorganizational collaborations: An empirical study of the global construction industry. *Journal of International Management*, 4(2), 85-107.
- Schneider, B., Ehrhart, M. G., & Macey, W. H. (2013). Organizational Climate and Culture. *Annual Review of Psychology*, 64, 361-388.
- Simatupang, T. M., & Sridharan, R. (2005). The collaboration index: a measure for supply chain collaboration. *International Journal of Physical Distribution & Logistics Management*, 35(1), 44-62.
- Van de Vliet, & Janssen. (2001). Description, explanation and prescription of negotiation techniques. In M. E. Turner (Ed.), *Groups at work: theory and research*. Mahwah, N.J.: L. Erlbaum.