21. Awareness and ability to act

Eilif Hjelseth[1], Kristine Slotina[1,3], Endre Sjøvold[2,4]
1 Norwegian University of Science and Technology, Department of Civil and Environmental Engineering
2 Norwegian University of Science and Technology, Department of Industrial Economics and Technology Management
3 Nordic Office of Architecture
4 SPGR institute AS

[1] https://orcid.org/0000-0002-9041-8288
[2] https://orcid.org/0000-0001-8546-2789
[3] https://orcid.org/0009-0004-3133-8415

Abstract

A team member's pattern of communication is the most important predictor of team performance. The large body of small-group research shows that different contexts require different group dynamics for high team performance. This study explores whether experienced project professionals are aware of the optimum meeting environment (in-person, virtual or hybrid) when coordinating, cooperating or collaborating to solve tasks. The digital transformation enables new ways to organise in-person, virtual and hybrid meetings. We chose to investigate a specific kind of meeting called Integrated Concurrent Engineering (ICE) sessions. ICE-sessions are highly structured, strongly supported by technology and ambition for high efficiency, being both a means for effective collaboration and a means to solve complex problems. We gathered data using a questionnaire designed for the purpose of a standardised Systematize Person-Group Relation (SPGR) scale. As a strong structure invites a simple dynamic with less opposition, we studied if ICE-session members show sufficient awareness and opposition to identify and change when a shift to a more complex dynamic is mandatory. Our findings suggest that they do not. A framework has been developed to identify the relationship between "Awareness" and "Ability to act.

21.1 Introduction

Meetings can be performed in an in-person, virtual or hybrid environment. Awareness of other constraints like structure and group dynamics, or complexity and interdependencies is needed in the project. However, we lack appropriate terminology and framework to distinguish meetings. The whole field of small-group research agrees that a team's performance is tightly connected to its ability to change team dynamics according to contextual demands (Sjøvold et al., 2022). This important aspect is often overseen in practical project execution. In this respect, it is interesting to know which is optimal. This study explores this related to coordination, cooperation and collaboration levels, see Figure 1 in Chapter 1 by Sina & Klakegg (2023) for more information. The quality of communication in meetings is critical to the performance of the entire project. Research on High-Performance Teams (HPT) unequivocally states that it's mandatory that the team's pattern of communication matches the complexity of its context and tasks. For a review of literature, see Sjøvold et al, 2022. We find, however, that awareness of group dynamics on team effectiveness is often missing, even in large projects. Our purpose is to increase this

awareness by discussing group dynamics along a continuum from highly structured meetings to innovative "free flowing" meetings capturing differences in communication patterns (dynamics) along this continuum shown in Figure 1, Chapter 1 by Sina & Klakegg (2023) labelled "*Coordination, Cooperation and Collaboration*". Distinctions between these labels can be made as follows:

- Coordination level is characterised by limited group dynamics, and a high degree of structure (procedures, technology etc.),
- Cooperation level is characterised by medium advanced group dynamics, medium support from structure, and
- Collaboration level is characterised by advanced and self-managed group dynamics and accordingly less support from structure.

Team members' pattern of communication and group dynamics is the most important predictor of team performance (Pentland, 2012). Effective teams are able to switch to the dynamics that best meet contextual demands and task complexity. In a stable context and non-ambivalent tasks, strict procedures and drills will always be most effective. On the contrary, in unclear situations and complex tasks, all members' skills, knowledge and experience are required, and the team needs far more advanced dynamics to perform. We can imagine a continuum from coordination at one end to collaboration at the other.

The key to high-performance projects is to be aware of when high structure simple group dynamics or low structure and advanced dynamics are the most effective given the purpose of the meeting. Generally, project complexity is increasing, both in the size of the projects, complexity and demands for performance. Starting prepared, following schedule, and having a high ratio in Percentage Plan Complete (PPC) is no longer sufficient. Sustainability requirements and circularity are examples that show the complexity of projects that require high-performance meetings. Even in highly structured ICE-sessions, we may run into unforeseen problems that increase the complexity, which in turn raises the need for a more advanced group dynamic or collaboration. A project team's awareness of when they need to shift dynamics and their ability to do so is essential.

Our research questions focus on how the different uses of in-person, virtual and hybrid communication channels impact group dynamics and structure in achieving objectives. The term "Construction Experts" is an inclusive term for domain experts like architects, engineers, contractors and building owners.

RQ1: - *How are the relationships between meeting structure and team dynamics related to the context of in-person, virtual, and hybrid settings?*

RQ2: - *To what degree are construction experts aware of influencing aspects of facilitating and participating in in-person, virtual, and hybrid meeting environments?*
The novelty of the research is related to the use of the identical type of meetings - Integrated Concurrent Engineering, ICE-sessions, as a reference for exploring the collaboration in in-person, virtual or hybrid meetings in relation to meeting structure and team dynamics.

21.2 Theoretical considerations

21.2.1 Digitalization and expert cultures in the AEC industry

The inherent complexity of a building project requires construction experts to coordinate, cooperate and collaborate - to transfer and create the knowledge and information necessary. In the mid-1960s, Computer-Aided Design (CAD) technology emerged – referring to all types of computer programs that can help with design and engineering work (Crotty 2012). The AEC industry has been transformed through this technological turn.

Today this information exchange is supported by digital technologies like Building Information Modelling (BIM), social methods like ICE sessions and frameworks like Virtual Design and Construction (VDC). These digital technologies will continue to change and adapt, influencing the way we work (Slotina et al., 2021). It is uncertain whether such development will improve the quality of collaboration, empower the way the AEC experts communicate and make them more connected; nevertheless, it is noted that such technology affects the way construction experts collaborate and work together.

21.2.2 Interaction and technology

The only reason for working in teams is when it is more efficient than the sum of individual contributions. Whether teamwork is effective, innovative or a waste of time is determined by the quality of its pattern of communication. Effective interaction when tasks are simple (sharing information and trivial decisions in predictable parts of the project) is fundamentally different from interaction that is effective when complex and unforeseen events with major consequences must be handled.

21.2.3 Virtual versus in-person interaction

When complicated and important decisions must be made, nonverbal communication is particularly important. There is no doubt that the tendency to opt out of virtual meetings when a lot is at stake is due to the limitations of technology. Low media-richness decreases members' ability to perceive subtle signals and high level of purpose dynamics challenging (Handke et al., 2020), which in turn leads to oversimplified "recipes" for the best virtual interaction (Gratton, 2020). This may be a severe risk when the going-gets-tough in an ICE-session with high-stakes topics.

The use of digitally supported interactions makes it easier to document the meetings, which is still an underestimated opportunity in projects and a basic intention of an ICE-session.
It may seem that hybrid teams will soon become the norm (Garro-Abarca et al., 2021). Virtual communication and its effect on group/dynamics in real workgroups are under-studied (Eisenberg & Krishnan, 2018; Messenger & Gschwind,2016). Most of the research has been done on student groups, and surprisingly few works are rooted in existing group theory or have aimed to build new theory in the field. In addition, the research focuses more on the dynamics of the individual than the group (Marlow et al., 2017). Despite obvious limitations, there is a great potential in using virtual interaction. As in-person teams, this requires a well-developed mutual trust or psychological safety (Breuer et al., 2016; Hacker et al., 2019).

21.2.4 The spin-theory for groups

We base our discussion on the spin-theory for groups (Sjøvold, 2007, 2022) which is an integrated theory for understanding the dynamics of groups. The most central concepts and assumptions in spin theory are the following:
1. There are *four basic group functions* that ensure the group's goal achievement and sustainability: Control, Caring, Opposition and Dependence (loyalty). Since these functions are expressed through team members' behaviour, they can both be observed when active and influenced.
2. A team's ability to *balance* behaviours supporting these four functions when confronting different situations and tasks, is a measure of a team's effectiveness.
3. The group's effectiveness depends on how well the group's interaction (dynamics) meets external demands (complexity of context and tasks). In spin-theory different team-dynamics are labelled *level of purpose*, see Table 21.1.

Factor	**Team at a high level of purpose (synergy)**	**Teams at low level of purpose (withdrawal)**
Focus	External – "flow"	Internal – "well oiled"
Trust	As a generalist "you challenge and confront me"	As an expert "you can and will support me"
Mental model	Open, under critical evaluation	Closed, taken for granted
Strength	Master complex tasks and unclear situations	Focused and energetic in defined situations
Weakness	Less automated responses, relatively slow in clearly defined situations	Helpless in complex and unforeseen situations
Management	The group is self-governing	The leader is strong and controlling

Table 21.1. Level of purpose exemplified by two extremes

In the language of *Level of Purpose (LOP),* Coordination is typically a low LOP, while Collaboration typically represents more advanced group dynamics at a higher LOP. A group with a high LOP dynamic is able to perform in a high degree of complexity. The relativity of *"trust"* across different *levels of purposes* is important for our further discussion

Multiple methods have been developed under the label SPGR (Systematize Person-Group Relation) for research based on the spin-theory some of which are used to gather data in this study.

21.2.5 VDC as context for high-performance meetings

This study explores interdisciplinary expert collaboration in virtual, in person and hybrid meetings, called ICE-session. These types of meetings are included in multiple frameworks such as Lean Construction, Integrated Project Delivery, Virtual Design and Construction (VDC), and others. This means that great emphasis is placed on utilising the use of BIM and various digital solutions for integrating design and construction communication processes - to meet the customer objectives. VDC at the operational level can be described as integrating the six elements in Figure 21.1. The integrated meetings in the VDC framework are called ICE-sessions.

Commented [S1]: Spelling error replace Built Environment caps

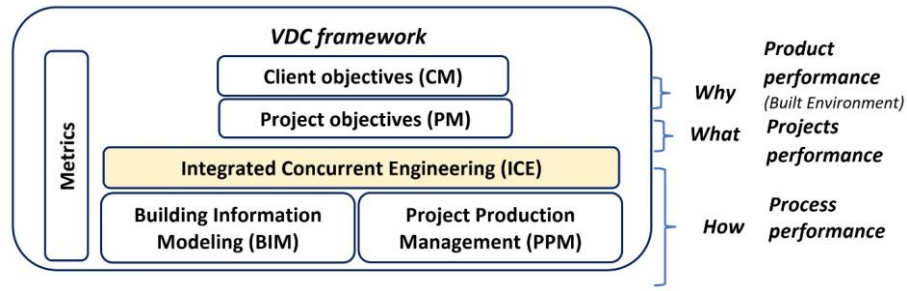

Figure 21.1. Overview of the VDC framework (Hjelseth, 2022)

21.2.6 Characteristics of Integrated Concurrent Engineering sessions (ICE-sessions)

An ICE-session is a well-organized activity where all relevant stakeholders are brought together to study multidisciplinary challenges. ICE sessions are particularly useful for clarifying interdependent (reciprocal) tasks (Fischer et al.,2017; Kunz & Fischer, 2020). In advance of the ICE-session, everyone receives an agenda and task list so that you can attend well prepared. This structured implementation aims to solve cases more efficiently, increase quality and reduce the time it takes to solve the various tasks. Each task is linked to a relevant actor. When there is a need to work in smaller groups or individually, it is treated as separate special meetings called “Break-out sessions”. The combination of joint ICE-sessions and dedicated break-out sessions is called the “Accordion Model”.

The ICE-session takes place in a well-equipped room, often called "Big Room", with sufficient space for everyone to work on their PCs and on joint active screens. An example of the organisation of a physical "Big Room" is shown in Figure 21.2. Note the extensive use of graphic presentations - "dashboards" of central information. Everyone can participate more actively in the discussions when you stand together in front of an active screen, than sitting behind their table.

Figure 21.2. Layout of «Big Room» for ICE-sessions (Source: Øyvind Børstad, HENT)

ICE-sessions can also be conducted in a “*Virtual Big Room*”. Digital implementations also provide new opportunities, e.g., increased flexibility and quality as it is easier to bring in professionals for short contributions.

21.3 Methodology

21.3.1 Data collection through net-based survey

The net-based survey included a combination of three open text and three multiple-choice answers, in addition to SPGR questions. Presentation of the open-text answers includes a simple thematic analysis to get preferences and a selection of statements. To improve understanding/interpretation, the results include reflections from the authors and external references. The net-based survey was sent to around 400 VDC-certified persons, and we got feedback from 34 persons (no reminders were sent). Around 50% were project design coordinators, 10 % were project managers, 15% were VDC coordinators, and the rest of the 25 % were from other disciplines. There was approximately equal representation between construction (buildings) and civil (infrastructure) engineering. This distribution corresponds well with the background of the course participants. Even if the number of responses is limited, they should be representative. The statistical analysis in 21.4.3 is based on a paired t-test. This group of respondents was chosen because they have a high understanding of ICE-sessions. The analysis of group dynamics was performed using the SPGR (Systematizing the Person-Group Relation) methodology (Sjøvold, 2007, 2022). We used a standardised 12-item SPGR scale. The respondents were asked to rate their colleagues and their own behaviours in the two contexts, virtual and in-person meetings, using the SPGR scale.

21.4 Results and Discussions

The survey included open-ended questions reported in A), B) and C) that resulted in long answers. For example, question A resulted in 28 open texts from 34 respondents, where 10 of the answers were 40 words or more. This indicates that the respondents were interested in the survey and motivated to answer extensively. The questions D), E) and F) are based on multiple-choice.

21.4.1 Open-ended questions

On the open text question: “What do you assess as the biggest advantage of IN-PERSON VDC sessions over VIRTUAL and HYBRID”. We observed that the most highlighted advantage of in-person communication was related to non-verbal communication.

Here is a collection of three statements that illustrate this awareness:

> *Communication - read body language - better conversation*
> *Gain insight into people's attitudes/settings as body language plays a significant role.*
> *Watch facial expressions and other non-verbal communication.*

These statements indicate the value of non-verbal communication. 1 out of 3 participants wrote terms like “*Understanding body language*” in their feedback. The answers also included terms like dynamic, energy, understanding and interpreting referring to a meeting break. This also indicates that these elements are missing in the virtual sessions.

> *“Increased joint understanding”* and *“more resilient decisions”*

These types of statements were highlighted by 1 out of 4 participants as a benefit of in-person meetings. This type for feedback indicates that the use of Percentage Plan Completed (PPC) is not enough to assess the outcome of tasks processed in ICE-sessions. This quote is presented as an example:

> *"To be a leader and know the dynamics of the meeting manage processes get more people to contribute more actively to the meeting commit the participants to decisions get something "more" by meeting, especially relationship building get good dynamics in the discussions and shed light on complex topics in a good way".*

On the open text question: "What do you assess as the biggest advantage of VIRTUAL VDC sessions versus IN-PERSON and HYBRID, the most preferred advantage for virtual is expressed by a typical answer:

"*Much more time- and cost-effective than in-person meetings"*

When it comes to sustainability, only one answer mentioned reduced CO_2 as an argument for virtual sessions. The answers mainly focused on production effectivity at an individual level and the benefit of being at office with access to all technological features.

The benefit of increased representation of project participants was mentioned by 1 out of 3 participants, along with the mention of increased participation from decision-makers. Notably three answers mentioned increased quality of the sessions because it was easier for "silent persons" (introverts) to join in discussions virtually. "Multi-tasking" when other themes than own were discussed was mentioned by 4 of 28 as a benefit of virtual sessions. To summarize, the advantages of in-person meetings suggest *a human interaction* in the project. On the other hand, virtual meetings indicate an advantage for *efficiency in task processing* and *inclusion of participants* in ICE-sessions.

The following statement from the survey participant corresponds to the data from the literature:

> "*There has nevertheless been a major change in the virtual meeting approach during the last 3 years*".

This consideration is a backbone for this 2023 study. We are in the middle of a technological shift and we have limited the survey to the comparison of in-person and virtual ICE-sessions. The results indicate that more digitally supported working processes are being implemented, for example: Building Information Models (BIM), virtual meeting notes and digital reporting of issues.

The last part of the survey included open comments on ICE-sessions. Here are some interesting comments related to arguments for different types of sessions:

"When I lead ICE-sessions, I think it is essential to be in-person present when we start a project or a phase in order to get to know each other a bit. It is very important to meet 1-2 times a year for good discussions, maintain relations and participate in evaluations that require discussion. In between the in-person session, it's absolutely great with virtual and hybrid meetings to land matters that are not process-oriented, but which only require a decision on a professional basis."

"The most central thing about the VDC methodology is the use and execution of good ICE-sessions. ICE-sessions must be well planned and have a clear agenda with specified cases that must be sent out in good time to get the right decision-makers to participate in the ICE-session. It is essential that information is provided about the cases which must be taken up in a good way so that all participants can prepare for the ICE-session."

21.4.2 Multiple-choice questions

Regarding number of projects in parallel. Around 45% have only one ongoing project - they can have full focus and be well prepared for each ICE-session. This leads to relatively small variations in meeting execution. Around 15% had 4 or more projects.

In-person ICE-session was run every second week or less often, while 2 out of 3 participants had the same frequency in virtual meetings. The results suggest they have time to prepare before and follow-up afterwards. Approximately 1 out of 3 have weekly virtual ICE-session. Having ICE-sessions as often suggests a different profile (more like a status or coordination meetings).

On the question: "What proportion of the meetings do you participate in-person (compared to virtually), the results were:

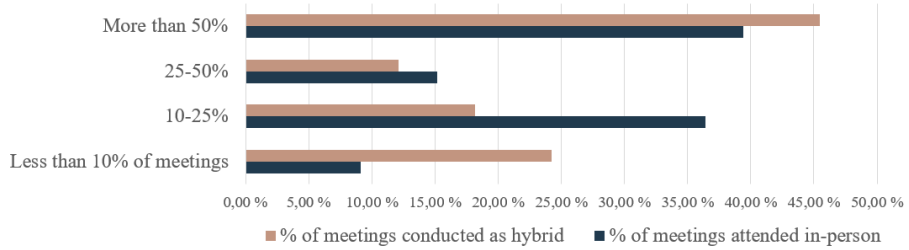

Figure 21.3. Proportion of meetings attended in-person and as hybrid meetings

These results show that virtual participation is mostly used. 3 out of 4 of the meetings are conducted with hybrid participation – the most challenging type of meeting. The difference in numbers indicates virtual attendance. The durations of ICE-session varied between virtual and in-person. Virtual meetings that last longer than 3 hours were under 10% and in-person - over 25%.

On the question, "*I prefer to attend ICE-sessions:"* is it interesting that 1 of 4 do not have a preference. This shows flexibility in how ICE-sessions are conducted. The results can be seen as contradictory to the feedback on question A) and B) above.

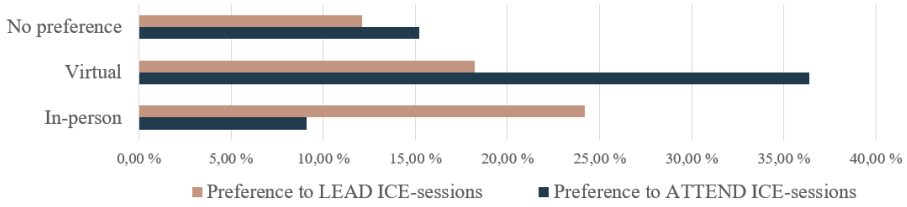

Figure 21.4. Preference to attend and lead ICE-sessions

This result corresponds in % with the participant role, but the arguments for in-person are more related to awareness of the process.One of the reflections indicates that this question could have been extended to open-ended question to reflect when and why each meeting type would work better:

> *"Physical meetings are rewarding at the start of a project where everyone must be involved, and major issues must be solved together. Digital solutions work better when the problems have become "smaller" and fewer participants are involved in the solution."*

21.4.3 Awareness of team-dynamics in in-person and virtual interactions

The awareness of how group dynamic is influenced by the structure of the meeting was limited among the project managers. Our findings suggest that increased awareness of how the members in an ICE-session collaborate will increase the effectiveness of such meetings. Such awareness will also enable an ICE team to deliberately choose the optimal type of dynamics (LOP) according to the actual task complexity. We suggest that skills in building tailored team dynamics are key to the performance of ICE-sessions.

Virtual, in-person and hybrid team-interaction

For a group to be able to operate at a high LOP, team-members must be able to catch all small verbal and non-verbal interactions and be able to react in a constructive way. Even with the most advanced technology that exists today, it is difficult to capture nuances in nonverbal communication in virtual interaction. This often results in (1) stereotypical perception of "the others", since the first impression a person gives, sticks better than in in-person meetings, (2) leaving space to the more outspoken members, which easily prevents other's actual skills and knowledge from being expressed (Alsharo et al., 2017), (3) leading us to misinterpret reactions until they are too late to handle since we unconsciously assume that others correctly perceive what we try to convey, and (4) ingroup favouritism and distribution of blame is common in semi co-located (hybrid meetings) (Asatiani & Penttinen, 2019). In short, mutual trust often suffers in virtual meetings and we will expect virtual and hybrid team to operate at a low LOP.

Our findings support this, showing significantly less behavioural support for all group functions, but Opposition, when comparing virtual and in-person meetings.

Table 21.2 presents the results when the respondents are asked to rate their teammates, and Table 21.3 when they are asked to rate themself in the contexts. Although the respondents rate themselves more similar in the two contexts than their colleagues, the overall pattern is roughly the same.

Vector	**Typical behaviour**	**In-person**	**Virtual**	sign
1 Control	Effective, controlling	5.0	4.1	***
2 Opposition	Competitive, tough	2.2	2.4	
3 Nurture	Social, warm	4.3	3.1	**
4 Dependence	Obedient, diligent	8.0	6.0	*
5 Synergy	Inspiring, supportive	8.0	5.6	*
6 Withdrawal	Restrained, disillusioned	1.7	3.7	**

* p< 0.001 ** p< 0.010 ***p<0.050 *(t-test, two tailed, n=34)*
The number of respondents is sufficient for these kinds of studies, and the respondents are representative for the total population.

Table 21.2: Rating of my "colleagues'" behaviour in-person and virtual interaction

Vector	**Typical behaviour**	**In-person**	**Virtual**	sign
1 Control	Effective, controlling	5.1	5.0	
2 Opposition	Competitive, tough	1.4	2.0	
3 Nurture	Social, warm	4.7	3.6	***
4 Dependence	Obedient, diligent	7.9	6.1	*
5 Synergy	Inspiring, supportive	8.1	6.2	*
6 Withdrawal	Restrained, disillusioned	1.4	2.0	

* p< 0.001 ** p< 0.010 ***p<0.050 *(t-test, two tailed, n=34)*

Table 21.3 Rating "my own" behaviour in-person and virtual interaction

The first four vectors include behaviours supporting the four group functions: Control, Nurture, Opposition and Dependence. All functions but Opposition, are less supported when the team meets virtually than in-person; they are less task-oriented, less caring and show less loyalty. Behaviours included in *Vector 6* showed Withdrawal as more prominent in virtual meetings. These behaviours typically defer constructive teamwork. Effective teamwork is challenging in virtual meetings further supported by *Vector 5 Synergy* which includes behaviours that encourage constructive teamwork. Findings indicate that virtual meetings enforce a rougher interaction and less commitment than in-person meetings. This is supported by the open text answers in our survey.

Although virtual meetings in nature are structured, *Vector 1 Control* (see Table 21.3) is rated lower for virtual meetings. One explanation may be that team-members meet virtually with the same expectations for the interaction as if they would in-person (supported by survey data). Virtual meetings may require a more defined structure for interaction and procedures for dealing with the non-task-related parts of the communication. We often try to increase effectiveness in ICE-sessions by introducing stricter procedures and routines. This structure replaces what members otherwise would have solved through their interaction and in stable situations with unambiguous tasks, such a low LOP is the most effective (see Table 21.2).

Although not statistically significant, we see that *Vector 2 Opposition* is rated higher in virtual meetings. Opposition behaviour is important in building mutual trust, but negative criticism will destroy trust. Behaviours in *Vector 6 Withdrawal*, is rated significantly higher in virtual meetings, suggesting that it is easier to be unfair and unfriendly compared to in-person meetings. The significantly lower ratings for *Vector 3 Nurture*, and *Vector 5 Synergy* support this assumption.

Both our findings and the literature indicate that it is harder to obtain advanced group-dynamics in virtual meetings and that it is easier to behave less supportively. Although structure may increase effectiveness in virtual meetings when information is to be shared or clearly defined tasks are to be solved, challenges emerge when emotions are involved, and complexity increases. Humans have an ingrained scepticism, but also curiosity for the foreign. An effective way to kill curiosity is strict structure and "recipes". The reason is if we have all the answers, curiosity is no longer necessary, and our stereotypes prevail.

Structure, which is effective at a lower LOP, can therefore become an effective barrier to a group's development to a higher LOP. This is no problem for a well-planned ICE-session conducted according to plan but may be catastrophic if a serious incident appears. Communication characterised by curiosity, support and interest in others is what we want, even in the highly structured ICE-sessions, but due to the highly structured context, it is difficult to achieve, particularly in virtual meetings. From our studies in crisis teams, we find that introducing so-called “breakouts” to let members raise their concerns does not work (Stålseth et al, 2016). Working for a considerable time and intensively under structure hinders the mental shift necessary. The result is silence and finally the leader’s sole decision. For success in large, complex, and interdisciplinary projects it is mandatory to develop members' ability to correctly read the team process and intervene when necessary. This boils down to being *aware* of the match between team-dynamics and contextual demands and being *able to act* accordingly. We have summarised this discussion in Figure 21.5.

21.4.4 Practical implications

a) Team start-up

From the manager’s perspective, it is important to get the structure in place already in the first meeting in a virtual team. Members’ first impression of their fellow teammates is of great importance for how further interaction will proceed. Fixed routines, positive role models and mastery of a nuanced symbolic language are elements that make virtual interaction more effective (Eisenberg & Krishnan, 2018). The earlier procedures support

constructive interaction, the faster members will see the person behind their first impression. A good start-up provides predictability, which in turn provides security to share opinions and knowledge, which in turn develops trust between members (Mehtab et al., 2017).

b) Management
Group dynamics at a low Level of Purpose (LOP) and strong leadership will normally and almost automatically develop. This is not common in virtual teams (Staples & Webster, 2008). This may be related to technology acting as a substitute for management. In that case, facilitating virtual work through firmness in procedures can in most cases be good. The caveat is that a structure that is too strong will, like a strong leader, keep the group at a low LOP. The answer to this dilemma is to let the structure help the group to use the technology, but not to direct the group process itself. In this way, the apparent leader may imply an overlooked opportunity to increase the team's ability to operate at a higher level of purpose.

c) Virtual interaction: simplification, standardisation, attention
There are no user manuals for people, but there are for ICT (Information Communications Technology) systems. Simplifying and standardising the use of interaction technology may help members keep their attention to communication. If members, in addition, agree on a common "language" to show emotions and reactions that are difficult to perceive over virtual surfaces, it will be easier to express opposition in a constructive way. One element explaining the general success of ICE-sessions can be related to its contribution to enabling simplification, standardisation, and attention.

d) Importance of team training
Team training in this respect implies an open discussion in the team right after an ended session: How well did the structure of the meeting reinforce problem-solving? Did we manage to choose an appropriate group-dynamics? Was the meeting environment (in-person, virtual or hybrid) optimal for our purpose? Such short briefings are all that is needed. It's extremely powerful if regularly and systematically performed. Team-members understanding of what to look for in team-performance is crucial.

21.4.5 Architects` perspective on the digital world

As part of ongoing research, authors Slotina & Hjelseth (2023) investigated the way architects respond to the new meeting forms. As part of the findings, it was noted that architects are not part of the development of this kind of meeting structure. This can cause distress and a lack of trust towards this form of meeting. As part of architects` creative processes, architects use creative loops to iterate between different design proposals.
If this is true about one of the expert groups, this could also prove to be true with the others. ICE-sessions are presented to be a social method, though by limiting parts of the processes that different experts have, it fails to be inclusive. There could be a new challenge for ICE-sessions to create meetings that allow a more collaborative state of working together.

21.4.6 "Awareness" and "ability to act" for good communication

Awareness" is to be understood as the capacity to identify relevant factors which contribute to good communication in all types of meetings. "Ability to act" should be understood as the capacity to respond to unfavourable factors in the ongoing meeting and contribute to improvements for the next meetings.
The relation between "Awareness" and "Ability to act" is illustrated in Figure 21.5

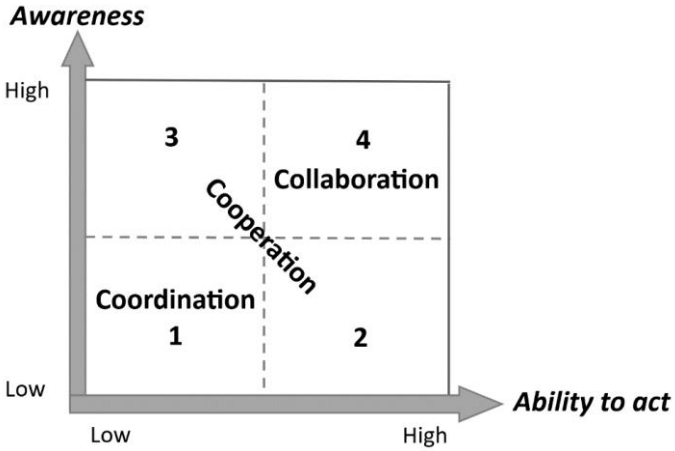

Figure 21.5. The relationships between awareness and the ability to act in meetings

Authors reflections about each "square" in the meeting:

1) ***Coordination*** - priority to get the job done without interruptions, clearly defined processes with minimal need for communication.
2) ***Cooperation*** - priority to have a good working environment, but it is not utilised sufficiently for team efficiency (e.g. Big Room used to have meetings in a traditional way). The awareness of how to improve team efficiency is limited.
3) ***Cooperation*** - priority to get the job done under the current context despite having an awareness of its impact; accept sub-optimal working environment and aim to do their best.
4) ***Collaboration*** - priority to work for best results – and try to improve the meeting environment constraints directly to achieve the best possible results in total.

Both "awareness" and "ability to act" are controllable factors on a personal level. Awareness can be increased by knowledge of the importance of factors contributing to good meeting environments. Ability to act is influenced by psychological factors such as opposition and/or resources to improve the meeting environment.

21.5 Conclusions

We have investigated ICE-sessions, since they are highly structured, strongly supported by technology and ambitions being both a means for effective coordination and a means to solve complex problems. A team's performance is tightly connected to its ability to change team dynamics according to contextual demands. Since a strong structure invites for a simple dynamic with less opposition, we wanted to study if professional and experienced ICE-sessions members show sufficient awareness and ability to act when a shift to a more complex dynamics is mandatory. We studied in-person, virtual and hybrid ICE- sessions.

RQ1: - *How are the relationships between meeting structure and team-dynamics in the meeting environment virtual context in -person, virtual, and hybrid settings?*

- Our findings support previous research showing that increased structure in a virtual context leads to less advanced group dynamics than in-person meetings. In addition, opposition in virtual contexts is expressed in a way that hinders members from speaking by interruption but enables anonymous comments in a better way. Hybrid environment is a challenge and requires very deliberate organisation of meetings.

RQ2: - *To what degree are construction experts aware of influencing aspects of facilitating and participating in in-person, virtual, and hybrid meeting environments?*

- Even highly experienced experts are not sufficiently conscious of the influence of team dynamics on the output of their teamwork. This may result in a continuation of a structured meeting, even when the situation claims for more mutual interaction than the 'effective' structure allows. We assume that in large, complex projects this is the main reason for deviations and exceeding costs.

Changing team dynamics when the structured context of ICE-sessions becomes too complex. Team-members must not only be aware of the dynamic they are in, but also feel that it is safe to raise their concerns in the group. This kind of positive opposition is more accepted in in-person environment. In virtual meetings, a higher degree of opposition is found, but it was expressed in a more negative way that hinder members' psychological safety.

The three Cs introduced in Figure 1 in Chapter 1 by Sina & Klakegg (2023); Coordination, Cooperation and Collaboration, represent a simple model pinpointing how team-members interact and communicate is crucial to the output of teamwork. Information sharing, uncomplicated decisions are best handled by Coordination-dynamics; while the same dynamic is catastrophic when complex, high impact decisions, are to be made. In collaboration dynamics, professionals must be trained to increase their awareness of changes in context and to act on this awareness. This is especially true for meetings that induce a high degree of structure and support of technology, like ICE-sessions.

The combination of awareness and ability to act related to the purpose of the project, structure of the meeting and team dynamics is critical to organise in-person, virtual and hybrid meetings in a successful way.

Reference list

Alsharo, M., Gregg, D. & Ramirez, R. (2017). Virtual team effectiveness: the role of knowledge sharing and trust. Information and Management, 54(4), 479–490.

Asatiani, A. & Penttinen, E. (2019). Constructing continuities in virtual work environments: Amultiple case study of two firms with differing degrees of virtuality. Information Systems Journal, 29(2), 484–513.

Breuer, C., Huffmeier, J. & Hertel, G. (2016). Does Trust Matter More in Virtual Teams? A Meta-Analysis of Trust and Team Effectiveness Considering Virtuality and Documentation as Moderators. Journal of Applied Psychology, 101(8), 1151–1177.

Crotty, R. (2012). The Impact of Building Information Modelling: Transforming Construction, 1st edn, New York, NY, 10001: Routledge.

Eisenberg, J. & Krishnan, A. (2018). Addressing virtual work challenges: learning from the field. Organization Management Journal, 15(2), 78–94

Fischer, M., Ashcraft, H.W, Reed, D. and Khanzode, A. (2017). Integrating Project Delivery, Willey, ISBN: 978-0-470-58735-5, 480 p.

Garro-Abarca, V., Palos-Sanchez, P. & Aguayo-Camacho, M. (2021). Virtual Teams in Times of Pandemic: Factors That Influence Performance. Frontiers in Psychology, 12, 232.

Gratton, L. (2020). Three elements for successful virtual working. MIT Sloan Management Review, april, 06, https://sloanreview.mit.edu/article/three-elements-for-successful-virtual-working/

Hacker, J. V., Johnson, M., Saunders, C. & Thayer, A. L. (2019). Trust in Virtual Teams: A Multidisciplinary Review and Integration. Australasian Journal of Information Systems, 23

Handke, L., Klonek, F., Parker, S. K. & Kauffeld, S. (2020). Interactive Effects of Team Virtuality and Work Design on Team Functioning. Small Group Research, 51(1), 3–47

Hjelseth, E. (2022). Virtual Design and Construction er… praksis, prinsipper og perspektiver. Praktisk økonomi & finans. volum 38 (1). https://www.idunn.no/doi/10.18261/pof.38.1.5

Kunz, J. & Fischer, M. (2020). Virtual design and construction, Construction Management and Economics, 38:4, 355-363, Laudon, Kenneth C. and Jane Price Laudon. 1998. Information Systems and the Internet. 4th ed. Harcourt College Publishers.
DOI: 10.1080/01446193.2020.1714068

Marlow, S. L., Lacerenza, C. N. & Salas, E. (2017). Communication in virtual teams: a conceptual framework and research agenda. Human Resource Management review, 27(4).

Mehtab, K., Rehman, A., Ishfaq, I. & Jamil, R. A. (2017). Virtual leadership: A Review Paper. Mediterranean Journal of Social Sciences, 8(4), 1.

Messenger, J. C. & Gschwind, L. (2016). Three generations of telework: New ICTs and the revolution from home office to virtual office, New technology. Work and employment, 31(3)

Pentland, A. S. (2012). The new science of building great teams. Harvard Business Review, 90(4), 60-69.

Sina, M. & Klakegg, O. J (2023). Chapter 1: Basis for Collaborative Practices Definition of Coordination, Collaboration, and Cooperation, Routledge Handbook of Collaboration in Construction (In Print).

Sjøvold, E. (2007). Systematizing person-group relations (SPGR) a field theory of social interaction. Small Group Research, 38(5), 615-635.

Sjøvold, E., Olsen, T. R., & Heldal, F. (2022). Use of Technology in the Study of Team-Interaction and Performance. Small Group Research, 53(4), 596-630.

Slotina, K., Hensel, M. U., & Hjelseth, E. (2021). Techno-Anthropological Inquiry into VDC Impact on Expert Collaboration in the AEC Industry - Interdisciplinary interactions through Virtual Design and Construction (VDC). Proceedings of the 39th eCAADe Conference - Volume 1, University of Novi Sad, Serbia, 8-10 September 2021, pp. 151-160, CUMINCAD. Retrieved from http://papers.cumincad.org/cgi-bin/works/paper/ecaade2021_215

Slotina, K. & Hjelseth, E. (2023). Exploring architects' perspective on the digital world using PPT framework. 1st International Conference on Digital Architecture Research, Faculty of Architecture Bialystok University of Technology, 1st - 3rd of March 2023, ISBN: 978-83-67185-55-4 (ebook) DOI: 10.24427/978-83-67185-55-4, http://dare-conf.eu/#publication

Stålsett, K., Sjøvold, E., & Olsen, T. R. (2016). From routine to uncertainty: Leading adaptable teams within integrated operations. Scandinavian Psychologist, 3.

Staples, D. S. & Webster, J. (2008). Exploring the effects of trust, task interdependence and virtualness on knowledge sharing in teams. Information systems journal, 18(6), 617–640