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**Doctor of the Built Environment
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**How factors of collaboration affect
delivery of construction projects with
a high degree of reliance on building
services; An action research and
cross-case study analysis of
Edinburgh Primary Schools**

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Volume 2

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APPENDIX D – THE CASE STUDIES : SOCIAL NETWORK RESPONSE

Chapter 5 provides the Cross-Case Study analysis. The following sections are the fuller analysis of same and are titled as the Case Studies (0-3) elsewhere;

- D.0 : Case Study 0 – St John’s Primary School (SJPS)
- D.1: Case Study 1 – Broomhills Primary School (BPS)
- D.2 : Case Study 2 – Victoria Primary School (VPS)
- D.3 : Case Study 3 – Canaan Lane Primary School (CLPS)
- D.4 : Side Case Study – Renton Primary School campus (RPS)

The Presentation of the case study data

Case Studies 0-3 are presented within Appendix D in identical ways; Case Study outline, Notable events, and the data collected, analysed and outcomes. An overall case study summary is provided at the end of each case study section. The Side Case Study, given the different approach, is outlined differently but still refers to the main themes and theories derived.

The data collected/analysed is presented in the following way, reflecting the *collection vehicle*;

Section 1 – Interview Questions

1. Trust and project delivery
2. Trust and knowledge transfer
3. Differing inter-actor perception of trust
4. Client definition of objectives
5. Collaboration and Building Services

It should be noted that due to the nature of the teams involved in case studies 1 to 3, there were common comments that were applicable to these case studies. For the sake of brevity, common observations and comments have not been repeated, but are contained largely within case study 1 (BPS). Where this occurs, "Refer to Case Study 1" is annotated. Case studies 2 and 3 thereafter have specific comments were they are in direct relation to these projects. This means that the narrative aspects of case studies 2 and 3 are shorter than case study 1.

Direct quotations from the interviews are highlighted in italics. Additional direct quotations are included in Appendix C.

Section 2 – Social Network Analysis

Network connectivity

Scored response to:

Trust

Collaboration

Transfer of Knowledge

Professional relationship

Within the presentation of the data are elements discussing relevant statistical tests, SNA standard mathematical tests, noted bias, and comparison drawn between the two time periods noted (3 months prior to contract execution and 3 months afterwards) and the individual actors.

Scored responses to SNA questions

It should be noted that two members of the network within case study 0 (BSS-E and BSS-M) are not included within this element of the study as they were not present in the time frames discussed (although they were considered part of the network).

The questions posed where;

- What degree of trust do you have in each actor?
- What degree of collaboration is there with each actor?
- What degree of Transfer of Knowledge is there with each actor - Separately, *To actor* and *From actor*?
- What is the manner of relationship between yourself and each actor?

Each was to be scored on an *ordinal* scale as described;

Guideline for scoring				
Score	Trust	Collaboration	Knowledge transfer	Relationship
0	No trust	None	None	Extremely poor
1	Little / minimal trust	Little or minimal	Little and not on time	Poor
2	Some, middling amount	Middling amount of	Middling and on time	Fair
3	Mostly trusting	High degree of	High degree and timely	Good
4	Absolute trust	Very High degree of	Delivered prior to requested	Excellent

Table D.i : SNA Scoring matrix

Where there is NO CONNECTIVITY to an actor no score is included within the data analysis. This differs to where an actor indicates connectivity but scores another actor as 0. This required a degree of rationalisation of data provided from some actors as they appeared to have, in a very small number of instances, *over-estimated* their connectivity prior to Contract execution.

The data is presented, and comparison is made in accordance with the two time frames being studied.

The data provided is largely quantitative and so is represented numerically and statistically herein. Inferences and comments are then provided. The following is shown for each question.

- The Mean is shown as an indicator of the networks position.
- The Mode is shown as an indicator of the most common score given by the network members.
- The Standard Deviation (SD) is shown as an indication of how much the members of the network differ from the mean

- The Coefficient of Variation (CoV) is defined as the ratio of the standard deviation to the mean. It shows the extent of variability in relation to the mean of the population.
- The number of responses within 1, 2, and 3 SDs is also indicated

A further comparison is made of how each actor scored compared to the reciprocal scoring of other actors, in order to review the discrepancy between scoring and if there was a potential correlation in this relational data.

The meaning/basis of table inclusions is:

Average difference: mean of difference in scoring taking account of it being a positive or negative difference

Average magnitude: mean of difference in scoring independent of positive or negative.

Difference: Negative value indicates less trusting/collaboration etc. than reciprocal scoring

Positive value indicates more trusting/collaboration etc. than reciprocal scoring

Magnitude: “Minimal difference” <0.5 on average

“Mid-range difference” between 0.5 and 1.0 on average

“Significant difference” >1.0 on average.

In addition to the above (and as indicated in each response element) a further statistical analysis was undertaken. A measure of *Relative Importance* was undertaken using a Relative Importance Index (RII) measure to indicate and assess the propensity of the individual respondents to a more positive or negative response compared to the network as a whole. It is also used to cross-check the *normality* (or otherwise) of the distribution of the data, and then provide an overall view of the respondents in each question category and how general attitudes changed. The summary of this indexation is included in each case study, with only reference to the RII outcomes of specific note included in the question-specific sections following.

RII use explained

- RII value shows the propensity for the individual to have a positive/negative view of the network connections under each heading; a score of 1 being the most positive (all 4's). Lower values show less positive response.
- Difference from the average, shows the degree of variance from the average for all the network.
- Standard deviation range shows how many SD's each are from the "midpoint"; within 1 would be a measure of agreement within the network, and % of "within1" will be a comparator for each response
- Under the *three-sigma rule of thumb*, 68% within 1 SD would mean a *normal* distribution. 99% of all data within 3 SDs to be normal.

D.0 Case Study 0 – St John’s Primary School (SJPS)



D.0.1 Case study outline

St John’s Primary School, Portobello, Edinburgh (SJPS) is situated to the East of Edinburgh. There was an existing School with the new build project to be a “tandem build” (build new adjacent, operate, demolish existing) on the adjoining site. The adjoining site was the site of the existing Portobello High School, which was being replaced by a separate project on a remote site. The demolition of the High School was due to be part of the High School project but, due to late delivery of that project, was eventually subsumed into the SJPS project.

The new SJPS was to be a 2-stream Primary school (7 years, 462 pupils) with a 60-place nursery included, along with playground areas and a new 7-a-side synthetic pitch for school and community use.

Initially the SJPS project was to be procured through HUB model (HUBSE) due to being partially funded by Scottish Futures Trust (SFT). These are Scottish government backed collaborative vehicles to deliver construction and infrastructure projects where local authorities or public bodies require governance or budgetary assistance to deliver required assets.

The SJPS project went through an early development iteration with HUBSE but then the Client Sponsor, Senior Responsible Office (SRO), determined that they did not appear to be getting “best value” from this approach and reverted to CEC’s own, newly formed, Frameworks. However, the project still attracted a degree of governmental (SFT) funding and, as such, required to conform to SFT metric measures (Area and Cost) and report in certain areas within their governance. Due to the earlier briefing protocol, the Client had clearly defined requirements to be met by the project.

NOTE: Client Sponsor, SRO, changed during this project’s delivery. The newly appointed SRO remained on all projects within this research.

The CEC applicable Frameworks to this research:

- Professional Services for Project Management, Quantity Surveying and Design Services
- Contractor (Major projects)

The project team was formed at RIBA Stage 1 but had the same Architect who was involved in the earlier HUB iteration. They were also noted as Lead Designer.

The Project development then followed the RIBA plan of works through the design stages with all project team involved. Refer to Table D.0.1 for timeline and values. The team encountered design and budgetary challenges throughout this process, requiring design, risk, and value engineering responses. However, the project passed through all key milestones and was signed off to tender as a Traditional Single stage Work Package call-off from the CEC Contractor Framework (Major projects). This was tendered on the basis of a 40% Cost / 60% Quality basis.

Stage	Date	Value	Building Services %	Comments
Project Inception / Stage 2	3/12/15	£10,822,000	33%	Benchmark information with outline designs
Stage 3	31/03/16	£11,513,000	29%	Developed design
Stage 4	7/11/16	£10,597,000	31%	VE undertaken between Stages 3 and 4
Contract	1/06/17	£10,211,000	27%	Following Tender process
Completion / FA	14/08/18	£11,112,000	26%	Decreased due to amount of non-services post contract change, including extensions of time and interior design incorporation.

Table D.0.1 - Key milestones and values

Grahams Construction Limited (GCL) were selected from the tender process. The project commenced on site in June 2017 with a completion date set for mid-August 2018 to coincide with the school opening for the new school year (2018/2019).

D.0.2 Notable events/issues in delivery

A number of events or issues that are relevant to the case study are included here .

- i. During design stages (prior to Tender) there were some issues of co-ordination between Architecture and Structural design. This meant there were disagreements within the Design team. This further manifested itself in the level of information for Billing and Tender, particularly for the Structural aspect. Ultimately this then meant, during construction, there was a degree of design development required which was the responsibility of the Designers, and this led to a programme delay which was not the Contractor's responsibility. It also meant that relationships between some of the Design team members were not as collaborative as they could have been.

- ii. Following Contractor appointment a Collaborative workshop was held, prior to site start. This involved ALL members of the team. No Sub-Contractors were represented. It outlined the project requirements, acted as an icebreaker, reviewed the main risks in the project, and described how the project team wanted to approach the Contract with a collaborative ethos. All parties agreed to the principles described and a “project charter” was created.

- iii. The Main Contractor was in a position whereby they could not appoint the MEP Subcontractor as early as would have been advisable, due to issues with the financial stability of the original MEP Subcontractor. The Main Contractor then had to re-arrange their supply chain provisions for this element; this took some time. It has been observed by members of the team that the appointment of the MEP Subcontractor was considered to be “late”. However, further observations note that, once appointed, the team as a whole were able to work collaboratively to attain desired outcomes.
Note: The above is not the recollection of one of the interviewees (CoL) and their testimony was queried during interview. They maintained that the MEP supply chain was engaged effectively and in a timely way.

- iv. A number of key personnel changed during the delivery of the project; namely the Client-side Project Manager, the Contractor’s lead Project Manager / Site Lead, and the Contractor’s Commercial Manager. In addition, some of the MEP Subcontractor’s personnel originally engaged on the project moved elsewhere. This had an impact on relationships and is likely to have had an impact on delivery.

- v. Programme, and ultimately the Completion date, came under pressure due to a number of factors. These were:

- Late completion of the High School demolition works; meant Main works start date was delayed. Contractor worked proactively with Client Team to best mitigate the issues arising, including carrying out some of the completion works from the demolition contract.
 - Design development in areas of structure and MEP requirements which affected the critical path of the programme. Required alterations to steel work, framing out, and other aspects.
 - Client Change; additional requirements
 - Incorporation of interior design requirements; including late information on the level of attendance on furniture installation and the like.
 - Inclement weather
- vi. The delay caused a degree of friction between parties as progress was questioned, including apportionment of blame and elements of protectionism (of person and organisation). Ultimately the entire team had to work together to ensure delivery. This involved a significant effort from the Contractor and included acceleration measures, additional resource, and reprogramming of works.

D.0.3 Section 1 – Interview Questions

1. Trust and project delivery

Q1.1 - In general, what is your view on trust and the role it plays in project delivery?

The respondents appeared to be largely in agreement with each other in that trust is considered “*essential*”, “*important*”, “*crucial*”, and necessary for successful delivery, and that “*it is important to be able to trust other team member’s abilities and that they will “do their jobs” effectively.*”

The lack of trust was expressed as being a root cause of issues within teams, failures or the inability to deliver successfully.

There was acknowledgement that trusting at the commencement of a project with new team members can prove difficult, particularly when key leadership does not provide an initial level of trust due to their personal agenda or opinions.

Project processes are “*more streamlined*” when everyone is willing to be open and honest, and when problems arise during the lifecycle there has to be reliance on *the team*; both of these aspects require trust.

“I don’t think you can deliver a successful project from a time, cost, quality perspective if you don’t have team members who collaborate, and you have to trust the opinions and the professional viewpoints of each”

On failures of Trust :

“where there is a failure of trust, it has a very detrimental effect on the final outcome.”

On intra-discipline working and delivery :

“We never get it all right and we need to be able to trust each other to help sort out these problems and I think there needs to be more of a focus on us as a collective rather than us as individuals”

Q1.2 - Specifically for this project, how do you think the level of trust between the actors had an impact on Delivery?

There was a consensus that, with a high level of trust, there were benefits to the delivery of SJPS ultimately. The notion of the cascading of trust on this project was prevalent and that the appropriate trust relationships were in place to enable success. There were specific comments on the trust levels between various *factions* within the team, where some had a high degree and some less so.

Some commented that the team was new to one another, but that trust grew very quickly as individuals delivered on initial targets and requirements. The collaborative workshop undertaken prior to site start was noted as

engendering trust. However there were comments on a particular team relationship where trust was lost due to not delivering as required and this caused issues of trust generally, was “*detrimental*” to the project, promulgated degradation in team relationships, and ultimately led to contractual issues.

The strength and nature of personalities was noted as a driving force within the trust relationship, but that this also meant any breakdown was significant (due to its personal nature) and resolving issues proved difficult.

There was particular reference to a lack of trust in certain aspects of the building services, specifically in the areas of design requirements from the supply chain and commercial issues of same. One respondent commented that the lack of trust having a “*major impact*” on the delivery of the building services specifically albeit that, in the end, there was success.

On the *NEED* for trust and the impact this had on outcomes; “*we had the need for a fairly high level of trust between all the actors involved. I think that was borne out by the final outcome because in spite of the difficulties which we encountered, they were largely overcome and had there been no trust or little trust between the actors the outcome would have been far more contentious*”.

On how encouraging trust can be done effectively; “*The collaborative workshop idea is something that should be done on every project*” and on how individuals have an impact on teams; “*some of the personalities on the construction side; they engendered trust because of their personality, whether they were trustworthy or not I don’t know*”. And how, in the end, trust was required to get the project completed; “*towards the end of the project when it was struggling and it looked like it was going to be delayed, we put a lot of trust in the main contractor, and accepted things as they were and that they were doing what they could in order to do it or otherwise it wouldn’t have opened on time*”

On *specific* trust relationship highlighted by others in the team :

“*There was quite a significant lack of trust relationship between the architect and structural engineer ... and as a result it, actually because of the way it*

hadn't been nipped in the bud, it ended up having a cost and quality impact further down the line."

Q1.3 - Specifically for this project, what level of trust do you think was active between the actors?

Commented on as being "*high*" and "*strong*" in general, there were also key comments made regarding it being poor between two key members of the design team, and that this had an impact. But there were also a number of comments from the Contractor actors stating that they thought "*at times it could have been better*" and that also there were instances where the design actors seemed to be "*trying to catch out*" the Contractor. This doesn't reflect a trusting relationship and is contrasted by comments such as "*it was one of the better projects I have been involved in and that certain actors were behind driving that*" and "*in the operational side of things the main players trusted each other and were all communicating well*". It was also noted that the trust relationship between Client, Project Manager and Cost Manager was particularly strong; "*in the operational side of things the main players trusted each other and were all communicating well*". On the subject of where trust was potentially weak, "*the Civil & Structural Engineering aspects of the project were the weak link and largely this was due to the commercial approach of the company delivering the service*"

2. Trust and knowledge transfer

Q2.1 - In general, what is your view on the role of trust in the transfer of Project knowledge?

The respondents were not as effusive as they were than in Q1.1, and a number commented on the complexity of the process of knowledge transfer. Whilst one actor noted "*It's paramount, you have to be able to communicate your ideas or what you are doing and similarly with everybody else in the team, and you have to bring people with you*", some commented that it is not

as reliant on trust *per se* and is more a “*mechanical process*”; and can be a personal issue. Comments on the “personal” nature of the trust aspect of the transfer of knowledge were; *“I do trust some of their professional integrity probably more than others and whether that is founded or whether that is a personal thing that happens just because I’m human is quite an intangible thing”*.

Others made note that traditional forms of contract do not rely on trust in this aspect and limit transfer. An element of trust has to be based on professional integrity, that the design does what it says, and there is nothing hidden. If there is a “*high degree of trust in the design*” then there should be a high degree of trust that knowledge is being transferred appropriately.

There were a number of comments on when the transfer of knowledge is best carried out, *“in Traditional Forms of Contract, it’s a ‘Design & Dump’, there’s not that transfer of knowledge from Design Team to Project Team. It’s about having the Contractor in at the right stage to assist the Designers with how best to design it”* and the nature of that transfer, *“There are problems in how design is communicated and that erodes trust.”*, and even if trust can be misplaced, and the issue this causes.

Q2.2 - Specifically for this project, how do you think the level of trust between the actors had an impact on the transfer of key knowledge?

Whilst there was consensus that at the beginning of the construction process that trust was high and positive between the parties and that this enabled good transfer of knowledge, issues arose during the build and there was a degradation of this trust and the effective transfer of knowledge, in a number of directions; *“a little later when things became tense and programme pressures increased, there was a pressure on the Contractor to deliver and in doing so, perhaps, some contract information was perhaps not as well delivered as well as it might have been.”*

Two factors were alluded to in this area; the late appointment of the building services sub-contractor and the change in one member of the PM team. The

commercial issues within the Building Services element meant that there was tension particularly in the Contractor Designed portions and the transfer of knowledge between relevant actors; *“the late appointment of the M&E contractor and then their responding to technical submissions; there was a certain element where the design response was very late in coming forward and when they did come forward it wasn’t as the specification, the drawings and the knowledge that had been transferred to the Contractor.”* And *“I think overall it was good. I think there were specific instances where the transfer of knowledge was diluted for often commercial considerations”*

The loss of an actor (PM1) who was central to communication and collaborative activities had an impact on trust in certain areas and the communication of knowledge and requirements; *“The change in PM during the project had a negative effect as the trust built up was then lost to a degree. It had to be rebuilt and it does take a while to build up a trust in relationships”*.

One Contractor actor stated that they thought that a *“blame culture”* existed in executing the design (from some members of the Design team) and that this hindered an appropriate flow of information. Another Contractor actor noted that there was a degree of *feedback* in this area; where a degradation of trust hampered information transfer from Design team to Contractor, which had an impact on trust in itself, which then affected the responsive transfer of knowledge back to the Design team from the Contractor. There were a number of cases noted in meeting minutes where timely provision of design information (knowledge) was not as required, by both parties.

Q2.3 - Specifically for this project, how effective was the transfer of key knowledge?

The responses to this question reflect Q2.2; Largely effective, but with issues around late appointment of building services subcontractor; *“Whilst it was generally effective, there were issues around the late appointment of Sub-Contractors for example which had the impact of then slowing down the*

information flow back to the Consultants for approval or comment, and then pressure placed upon these Consultants to turn the information around.”, and that it “could have been better” in some instances. Some actors felt that between the design team it was very effective (notwithstanding one actor’s failings), and that the communication of initial design was done well. As one actor succinctly put it “It didn’t NOT happen!” and that the project benefitted from “using the collaborative working environment”, and that the team effort approach ultimately assisted.

On aspects related to the Building Services:

“Reasonably effective; it wasn’t the best ever. The key knowledge from the contractor to the Design Team for some of the plant and things they were proposing was not effective at all, it was very poor. Primarily I think it was because they had a cost issue.”

3. Differing inter-actor perception of trust

Q3.1 - In general, what is your view on the perception of differing levels of trust between construction project actors, and how this affects inter-project relationships?

There was general agreement between the respondents that differing perceptions of trust levels between actors would have a negative impact on relationships between parties, *“It must affect other project relationships”*. One note that it would have *“catastrophic”* impact in relationships for those where processes are reliant on trust. Another noted that *“when there is differing levels of trust that’s when tensions arise”*, and another stated *“you start from a position where you believe, and you trust, and we expect that belief and trust to be reciprocated”*. On the wider team and the requirements for equitable trust there was a number of similar comments; *“There needs to be similar trust across the board. As soon as you get some kind of breakdown from one member of one team, it maybe starts to cast some doubts”* and *“when there’s a different perception of trust between the actors, doors start shutting if you*

like and you're protective of your organisation rather than being open in that relationship"

Q3.2 - Specifically for this project, what is your view on how different perceptions of the levels of trust between actors affected relationships?

There was a mixture of comments to this question, and some were not direct answers to it; more so the answers were about failures of trust. However, there was a generalisable division between the answers in that some noted that varying levels of trust between some actors were not apparent and that when conflict arose it was almost on an equitable basis; *"I think that conflict affected trust and the possibility of a break down at various points. There were a few areas where that certainly happened. But, having said that, I think right through to the end there was a fairly good level of trust, and the relationship didn't break down, so that trust obviously continued."*

Others commented on the overall outcome indicating that, if there were different levels and perceptions of trust, it did not have a negative outcome ultimately; *"despite some of the challenges that cropped up, I believe that everybody was invested in the overall success of the project, and I didn't really see any extremes. I think everybody made an effort to try and understand each other and come towards the best solution as you could possibly get really to achieve what the Client wanted."*

Significantly there were a number of comments on the differing levels of trust in the appointed Contractor deployed by the Client team; *"This definitely affected the relationships. My perception is that when the main contractor was appointed there was some people who were automatically not trusting them; key people. That would necessarily affect other people's view of them particularly other ones who are further away from the actual relationship."*

Whilst some started from a point of trust, others did not and that this variation may have had an impact throughout the project; *"... because of the differing levels of what was going on and how people were feeling, I do think it was a manifestation of a paranoia perception."*

Q3.3 - Specifically for this project, to what level do you think any disparity in trust levels affected the outcomes of the Project Delivery?

Again, responses differed and did not necessarily address the aspect of disparity of trust directly. However, some key comments noted around key personalities and events are compelling; *“In the end it did not have a negative outcome because we had such a definitive end date, we had to basically pull together and there had to be a measure of compromise”* and, *“I think the relationship with the original PM was built up very well and it would have taken quite a lot to match that. That probably had an effect.”*

There were comments on where the potential levels of trust might have had an impact on meeting key dates etc.; *“Late delivery of information and concealed problems had an impact and, to that extent, there was an element of trust that was ill-founded. To some extent it meant that resolutions were based on compromise; a necessary, but not altogether comfortable, compromise”*, but ultimately it was the nature of the *desire to deliver* generally that got things done; *“Any disparity evident appeared to not have an effect on delivery because of the other team members and actually a fairly willing main contractor.”*

4. Client definition of objectives

Q4.1 - In general, what is your view on how the Client defining their key value objectives affects performance delivery?

Consensus between respondents stating that defining the objectives is *“essential”*, *“paramount”*, *“important”*, *“probably the main thing really”* in affecting the outcomes of a project; *“If the Client doesn’t communicate what their key value objectives are, You can’t deliver.”* It appears that there is a belief that the Client must be able to define what they expect from a project to enable the team to deliver and to be able to focus on key project aspects; *“I think it needs to go beyond the eternal triangle of quality, programme, and*

cost. There needs to be an identification of the objectives that are highly valued” One respondent states that if these aren’t defined and communicated effectively, teams are not able to deliver, supported by; “it is important for them to define what their objectives are very clearly and again what their definition of success for the project would be and that gives us all something to work towards for the various approaches and disciplines”

Q4.2 - For this project, what were the Client's value objectives and how were they defined?

Whilst it was evident from all respondents that the handover date, being determined by school term dates, was the key driver for the project, there were a number of comments regarding the lack of communicated value drivers generally. There were a number of respondents who commented that the objectives appeared to be communicated through the architectural brief, both in development and delivery. There was sympathy with the lead consultants and the Client representative; *“Stakeholder engagement was complex and frustrating. With some of them changing their minds often”.*

Simply put by different actors; *“My sense was the Client brief didn’t necessarily exist to the extent from the point of view of actually having key values drivers and objectives here. It was all technical brief.”* And *“We never saw a document that told you exactly what we had to do from the Client.”* Tellingly, it was stated that; *“They weren’t defined. There was a lack of clarity in the Brief. There appeared to be many actors with differing priorities in the Client body”*

On the subject of how the lack of brief might have affected delivery, but that the team DID deliver; *“Not wanting to speak ill of Clients, but the fact that we managed to deliver this project without a Brief and while we always recognise the Client wants the project on time and on budget, we delivered the project despite the Brief not being available to us and I think that speaks well for all the parties involved in the project.”*

Q4.3 - Specifically for this project, what is your view on how the Client's communication of value objectives have affected the team delivery?

The majority of the responses were quite negative in this respect. The lack of clarity in the briefing was “*detrimental*” and there was a noted *lack of Client control* by some team members. There were comments from design team members that, at times, they had a *filtered view* of requirements without being able to directly refer to a written brief, and this hampered them to a degree. Late changes that came about were “*because there were key value objectives that the Client really hadn’t thought about. They were implemented after the event which just increases cost and potentially delayed delivery*” and, were it not for the collaborative approach taken at the end of the project, there would have been a delay. One positive comment noted “*the collaboration workshop we did at the very beginning was good from a team building point of view and it set out clearly what might not have been written down, but what the objectives were for the school and the project. These objectives were always good to refer back to in the absence of a fully communicated briefing document.*”

Other comments noted the impact the lack of definitive brief had; “*The guess work aspect put pressure on everyone*” and, somewhat dramatically, “*I think the Client was completely out of control of the project. maybe the change in SRO was the problem? I think the poor level of control from the Client was due to their inability to prepare a proper Client brief.*”

Q4.4 - Specifically for this project, how do you think the manner of Client's communication of value objectives has impacted on the approach to collaboration between the delivery team?

Even though there were a number of comments regarding late communication of Client requirements or changes, the general consensus was that, due to the nature of the individuals, the organisations, and the overall team, the approach to, and the act of, collaboration was not necessarily diminished.

The time pressures imposed on the project appeared to galvanise the approach of some to enhance collaboration in order to meet the programme requirements. *“The discord that was happening because of the programme pressure, and not being able to meet it, then created a level of accord between all parties which got the job done.”* And further comment relating to this, and that poor communication of objectives might have had a quasi-positive influence; *“Because the Client didn’t communicate some things in good time, impacting on programme achievability, it forced a measure of trust in that you had to otherwise the project wasn’t going to be finished in time.”*

However, others note that the lack of quality definition did lead to some conflict and a failure in collaborative approach, which may have been avoided with earlier description; *“what was happening was all were working off different parameters so the PM was working across the parameters; we have to get this school opened at this time for this cost and it’s got to be a level of quality... although we didn’t actually know what that quality parameter was.”*

One of the Contractor team stated *“You’re going to expect everything’s not going to run smoothly, it’s how you manage the issues that define the project I would suggest. I felt St Johns, in that respect, was quite a good example of collaboration.”* Others reflected on collaboration being enacted from the outset with the Collaborative workshop.

5. Collaboration and Building Services

Q5.1 - In general, what is your view on how collaborative procurement of building services affects project outcomes when measured against "Client defined value requirements"?

A number of the actors referred to how important the building services are to projects, that they are usually the highest value subcontract, and that earlier involvement with specialist (especially with design responsibility) could only be a good thing; *“My sense is that, and I might be being a bit disparaging about our M&E Design colleagues, there is so much that the Contractor does*

on the delivery of M&E/Building Services aspects of the project that there is bound to be a strong collaboration” .

Some responses noted that a collaborative approach from design to delivery, involving all relevant parties, was a necessity in projects with such a high reliance on key systems, and were more likely then to meet Client requirements; *“Building Services are usually the biggest sub-contractor on the job, It is crucial to get buy-in from them from a very early stage so if you’ve got Client defined value requirements you almost need to go back to the Building Services. I think it’s the only way to make it work.”*

There were other comments on the benefits of collaborative procurement, such as;

- Buildability aspects of systems and the interface to fabric
- Earlier exposure to those that are going to manage the installations; *“It’s better to engage with the M&E Sub-Contractor earlier in the tender process, maybe even at negotiation phase”*
- With Contractor design responsibility, early design input can be essential

Other comments, which do not necessarily corroborate that collaborative procurement is beneficial for project outcomes but are relevant, included;

How measurement can actually be enacted; *“can collaboration be measured against the Client’s defined value requirements when the Client’s defined value requirements are not defined!”*

That the collaboration needs to be enacted as early as possible and include wider team members; *“I am all for bringing on a contractor as early as possible I know that there are different views about that but particularly with M&E. There needs to be a collaborative design between Client Building Operators, M&E designer and a M&E contractor.”*

And, damningly, which responds to the kernel of this research; *“The M&E profession and M&E procurement is not currently working in the best interests of Clients of the industry.”*

Q5.2 - Specifically for this project, how would you describe the approach to collaborative early engagement with the Building Services supply chain?

Two responses simply stated, *“Well we didn’t have that”* and *“I don’t think there was any at all.”* There were other comments which were on the basis of *“one of the weakest parts of the project”, “disjointed”* and *“disappointing”*.

Fair to say that this project failed to undertake collaborative early engagement with the Building Services supply chain. This is primarily viewed as being a factor of the late appointment of the building services subcontractor (albeit *one* of the Contractor team did not think this was the case in their response... *“Our M&E Contractor were engaged earlier on in the process, and we actually had selected them as our preferred partner during the tendering of the project.”* – this was not the case). Another of the Contractor team suggested *“we appointed the Contractor, I would suggest, 2 to 3 months too late, they should have been onboard earlier”*. One of the building services designers said that collaboration was *“insufficient to the extent it did not happen, and was even late for appointing contractor”*

Other comments relating to the nature of the procurement approach and the relationship once there was collaboration in the area of Building Services; *“I don’t think that was really appropriate on this project because it wasn’t a Design & Build, because it was traditional”* and *“Subcontractor appointment was disappointing as I would have liked them to be part of the tender package.”*, and on the ultimate relationship, *“When they did come onboard then, the collaboration between the M&E Designers and the M&E Sub-Contractors was quite good”*

Q5.3 - Specifically for this project, what effect did the approach to collaborative early engagement with the Building Services supply chain on delivering to Client defined value requirements?

Because of the lack of early engagement as noted in Q5.2, responses reflected that position, with comments such as; *“it didn’t happen and could be*

*said that the positive outcome happened **despite** the engagement” and “because we had such a good team the lack of early engagement did not have an effect on the delivery. I don’t think the early collaboration would have made much difference to this particular project but in general it could and should be something that you do.”*

On the timing of the engagement with the MEP subcontractor; *“That was an issue, and it was a bit ‘all woolly’ and I think if that had been hammered out earlier, which probably would have helped”,* and [if they had been appointed earlier]... *“certainly we could have thrashed out some of the issues that were apparent”.*

A different view from one of the Contractor representatives (not corroborated by others) : *“it was a great benefit to the project that they were engaged in early on to assist with the project challenges...”*

Q5.4 - Specifically for this project, in what way was the collaborative approach taken towards the Building Services Supply Chain effective?

Because of the late appointment and actors’ views on this, there are some differing views. These range from *“I think it’s not relevant”* to *“not effective”* to *“I don’t think there was a collaborative approach of the Building Services, especially not pre-contract”* and *“it was better than not happening at all. It was all little too late. It should have been much sooner pre-contract especially”.*

In principle, once there was engagement there was a good response in a collaborative sense, this is particularly commented on by the Contractor team and the building services designers; *“Open-mindedness with regards to that kind of thing and collaborating with supply chains is refreshing. If I’m being honest its quite hard; often other members of design team, especially architects, tend not to be so “open” on a traditional contract. I think [supply chains] sometimes know best.”* But there is a sense of lost opportunity in a lot of the responses, best summed up by; *“if you were to look at it the way it should have worked; if they had been in early, the right guys had been in*

early, and met the designers, I think it would have been fine... but that didn't happen".

On the subject of how prior relationships can assist in the process of collaboration and delivery; *"it was a testament to the relationship between our Designers and the Contractor and Sub-Contractor and I think that grew out of a recent project that they had both collaborated on previously, so they knew each other, and I think that helped enormously to deal with some of the challenges that every project throws up."*

General Comments provided by respondents

The opportunity was afforded to those interviewed to provide general comments on the subject matter (others are noted in Appendix C). Specifically in relation to the team and people involved; *"one thing was down to people's personal relationships and so in a way we were quite lucky to achieve the result we did... within time and, I believe, was within budget, and the school looks beautiful"* and *"I do think this project was quite special about how the way that team worked, and I think it was a very enjoyable team. there was disparity and disagreements and people felt differently, but there was a team ethos and I think that just saved the project by the skin of its teeth."*

Further, comment on how the personalities had an impact; *"I think the personalities just worked. I don't know if it was just a stroke of luck or if you'd managed to duplicate it on other projects, but I think everything just clicked into place and the project moved all the smoother for it."* And a reflection from one following them moving on; *"On the collaborative approach; I've now worked on 2 different projects since SJPS, and it's not been anywhere near the level we had there."*

D.0.4 Section 2 - The Network structure

The structure of the network being studied is expressed graphically and, in relation to key Social Network Analysis indicators, in numeric form. The two aspects considered are the *Network density* (a comparison of potential nodal links to that enacted within the network), and the *centrality* of the individual actors and as a collective.

The two key time frames of the study are represented (the 3 months prior to contract execution and the 3 months immediately following) and comparisons drawn.

Three months prior to Contract execution

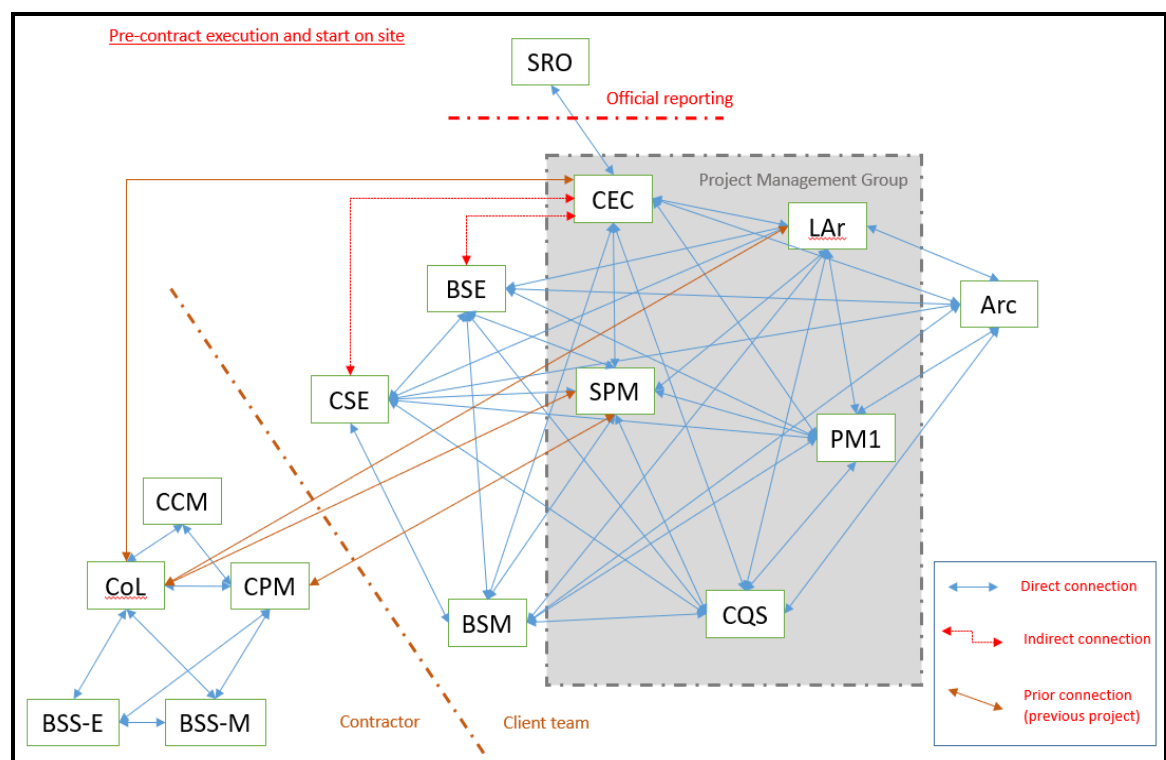


Figure D.0.1 : SNA diagram – SJPS, Pre-contract

Figure D.0.1 shows clear delineation between Client and Contractor teams, but also indicates that there are some connections that are pre-existing and that some of the client team are considered not fully connected. The Project

Management Group (PMG), which was the core of the Client team and project decision makers, members are situated in the grey shaded area.

Network density

Number of nodes	14
Total Number of potential links	91
Number of links present	44
Network density	0.484

The network density shown here indicates a density of just below 50%. Given that a significant proportion of the network had no contractual or *obligational* connection at this point, this is not entirely surprising.

Centrality

Client	CEC	0.615
	SPM	0.769
	PM1	0.615
	LAr	0.692
	Arc	0.615
	CSE	0.500
	BSM	0.577
	BSE	0.538
	CQS	0.615
Contractor	CoL	0.538
	CPM	0.385
	CCM	0.154
	BSS-E	0.231
	BSS-M	0.231
	Average centrality	0.505495
	Client Average	0.615385
	Contractor average	0.307692

Each actor's centrality score is noted along with a graded scale (green indicating high, red indicating low). Not surprisingly the Senior Project Manager has the highest centrality, with the members of the PMG all scoring highest.

The relatively low score of CSE reflects some of the comments in the response to interview questions. At this stage it is not

surprising that the Contractor contingent all score lower, as their connectivity is restricted by contractual positions. It is worth noting that CCM was not yet fully involved with the project and had limited connectivity.

Whilst centrality is generally referred to for individual actors within a network, the averages are included here for comparison to the second timeframe.

Three months following Contract execution

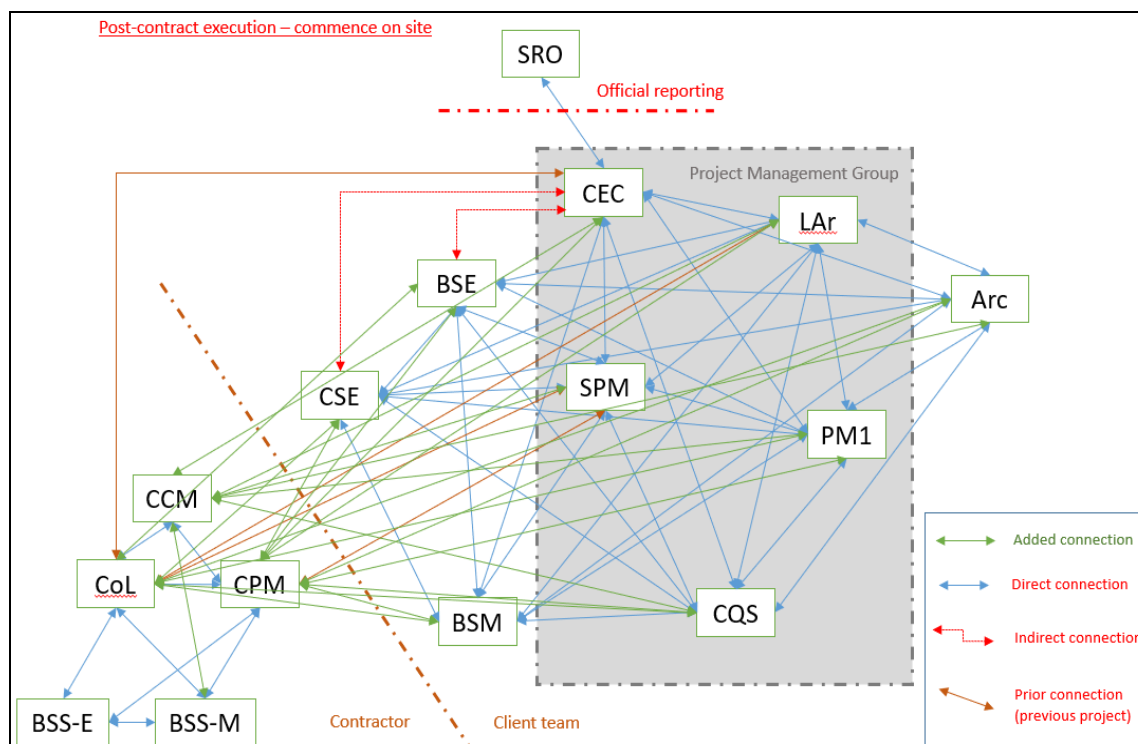


Figure D.0.2 : SNA diagram – SJPS, Post-contract

Figure D.0.2 is in the same format as the pre-contract version but now includes the additional connections (in green), which significantly adds a higher degree of density (in graphical terms at least)

Network density

Number of nodes	14
Total Number of potential links	91
Number of links present	65
Network density	0.714

The network density shown here indicates a density of just above 70%. A significant increase from pre-contract but still indicating some degree of lack of connectivity between a number of the actors.

Centrality

This shows that the delivery team (CoL and CPM) have taken a *more central* position in the network, in that they connect with everyone directly.

Client	CEC	0.769
	SPM	0.846
	PM1	0.846
	LAr	0.846
	Arc	0.846
	CSE	0.654
	BSM	0.731
	BSE	0.692
	CQS	0.846
Contractor	CoL	1.000
	CPM	1.000
	CCM	0.769
	BSS-E	0.231
	BSS-M	0.308
	average centrality	0.741758
	Client Average	0.786325
	Contractor average	0.661538

It indicates that CCM now also has a much more central role. The key aspect noted here is the lack of connectivity, or centrality, of the building services subcontractors, which reflects the comments made by the majority of the respondents to interview questions. It may be argued that there was no need for connectivity within the first 3 months of the

programme, but there were key co-ordination activities required. Another aspect is the comparatively low centrality of CSE at a time in the project where both civils and structural activities were most prevalent. Again, this reflects comments made in response to interview questions.

Network Density and Centrality

The two measures of a networks connectivity and activity are summarised here for the two periods considered.

	Network Density	Centrality
3 Months prior to Contract	0.484	0.505
3 Months after Contract	0.714	0.742

Comparative comments

The change between the two timeframes is as may be anticipated due to the nature of the traditional procurement approach. In addition, due to the actors being involved in a collaborative workshop around the same time as the contract execution, connectivity was increased.

However, only 19 additional connections were indicated in the analysis, and some considered that there was a lack of *direct connectivity* between some network actors in both time frames.

The significant increase in centrality for CCM (0.154 to 0.769) indicates the degree of procurement activity in the period studied and the requirements of their *connectivity* to undertake this. And yet, at this stage CCM did not have a connection with BSS-E, reflecting the noted *late appointment* of this key subcontractor.

D.0.5 Relative Importance Index

RII general outcomes

The data is summarised in table D.0.2 and figure D.0.3 to show the average RII response to the SNA questions for both Pre-Contract and Post-Contract periods. The shift in RII is then indicated to express if the actor had a more positive or negative view between the two periods.

	Average RII response		movement	
	Pre-Contract	Post Contract		
CEC	0.81	0.80	-0.01	less positive
SPM	0.85	0.84	-0.01	less positive
PM1	0.84	0.83	0.00	less positive
LAr	0.76	0.71	-0.05	less positive
Arc	0.86	0.84	-0.02	less positive
CSE	0.72	0.71	-0.01	less positive
BSM	0.79	0.76	-0.02	less positive
BSE	0.75	0.68	-0.07	less positive
CQS	0.85	0.84	-0.01	less positive
CoL	0.81	0.79	-0.02	less positive
CPM	0.80	0.85	0.05	same or more positive
CCM	0.76	0.76	0.00	same or more positive
Average	0.80	0.78	-0.01	less positive

Table D.0.2 : Overall RII responses

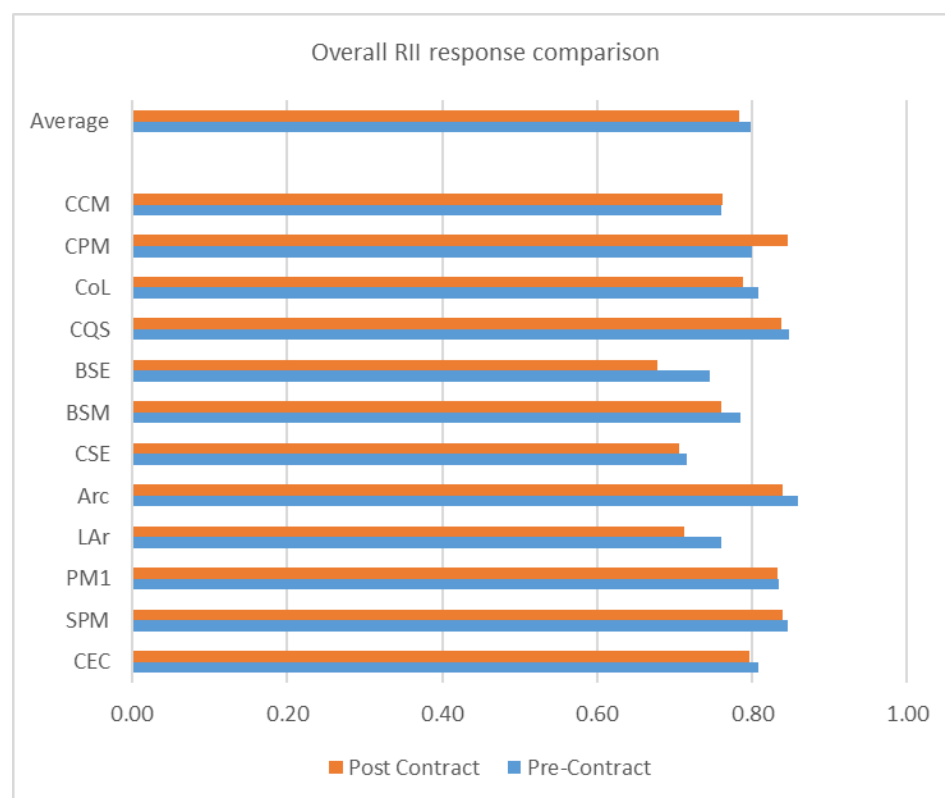


Figure D.0.3 : Overall RII response comparison

This indicates that the majority had a less positive view in the post-contract stage in scoring overall when all questions in the SNA section are considered. The difference here is with CPM and CCM. These two actors had a greater involvement in the team collaboration following Contract execution, so this could be expected.

Other notable movements are in relation to LAr and BSE who both note significant movement in their view. This is reflective of the issues discussed and noted from the interviews, in relation to design issues and late appointment of MEP subcontractor.

RII data distributions

Table D.0.3 indicates that, using the RII measure, the data is mostly in “*not normal*” distributions, and this is mostly reflected in the individual data analysis that follows. This does not represent an issue but has to be

recognised in the data analysis. It may be a factor of the data being collected from actors who express *very personal* views within the context of the SNA questions. Notably, the only question that elicits a “normal” distribution, through this measure, is in regards how each actor views the transfer of knowledge TO other actors. This suggests a more positive view of the network, and that each actor is likely to perceive their role in knowledge transfer more positively.

		within 1 SD	average range from SD	distribution
TRUST	Pre-contract	64%	0.73	not normal
TRUST	Post-contract	57%	0.88	not normal
Collaboration	Pre-contract	42%	0.87	not normal
Collaboration	Post-contract	58%	0.88	not normal
TRANSFER OF KNOWLEDGE TO ACTOR	Pre-contract	75%	0.72	normal
TRANSFER OF KNOWLEDGE TO ACTOR	Post-contract	75%	0.77	normal
TRANSFER OF KNOWLEDGE FROM ACTOR	Pre-contract	58%	0.90	not normal
TRANSFER OF KNOWLEDGE FROM ACTOR	Post-contract	67%	0.86	not normal
PROFESSIONAL RELATIONSHIP	Pre-contract	67%	0.78	not normal
PROFESSIONAL RELATIONSHIP	Post-contract	67%	0.87	not normal

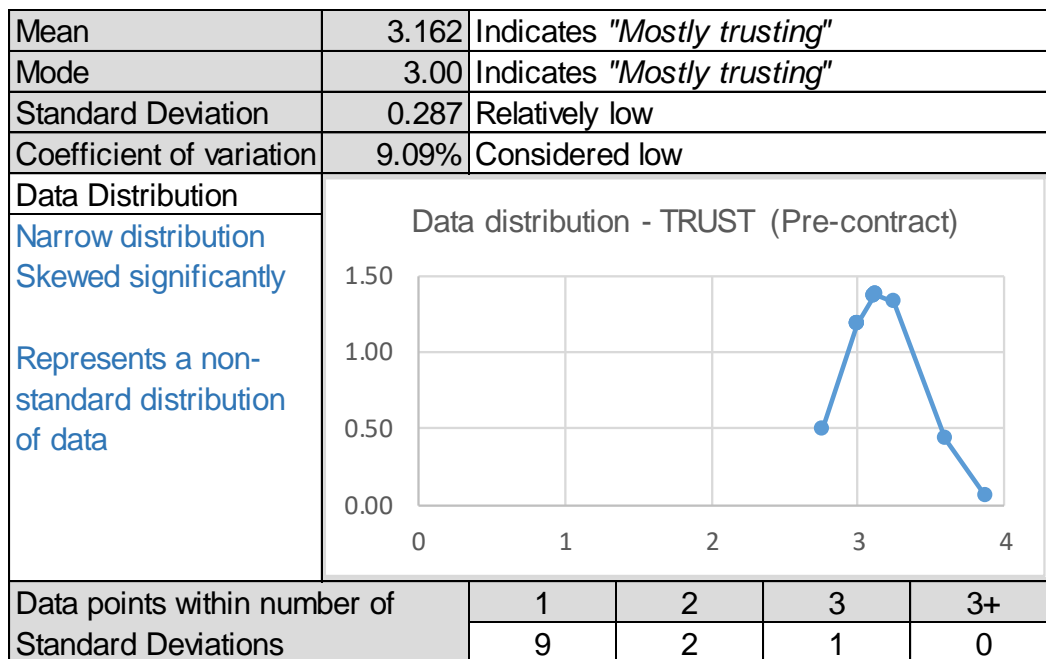
Table D.0.3 : RII data distributions

D.0.6 SNA Questions outcomes

What degree of trust do you have in each actor?

Three months prior to Contract execution

Trust (PRE): Individual scores response : *Figure D.0.6.1*



Trust (PRE): Individual reciprocal scores response : *Table D.0.6.1*

	Average score	Average difference	Average magnitude	Difference	Magnitude
CEC	3.11	-0.27	0.45	Less trust displayed	Minimal difference
SPM	3.60	0.45	0.64	More trust displayed	Mid-range difference
PM1	3.13	-0.18	0.18	Less trust displayed	Minimal difference
LAr	3.11	0.27	0.45	More trust displayed	Minimal difference
Arc	3.25	-0.09	0.64	Less trust displayed	Mid-range difference
CSE	2.75	0.36	0.36	More trust displayed	Minimal difference
BSM	3.13	-0.18	0.18	Less trust displayed	Minimal difference
BSE	3.00	-0.36	0.36	Less trust displayed	Minimal difference
CQS	3.88	0.00	0.00	Neutral trust displayed	No difference
CoL	3.00	0.27	0.27	More trust displayed	Minimal difference
CPM	3.00	-0.18	0.18	Less trust displayed	Minimal difference
CCM	3.00	-0.09	0.09	Less trust displayed	Minimal difference

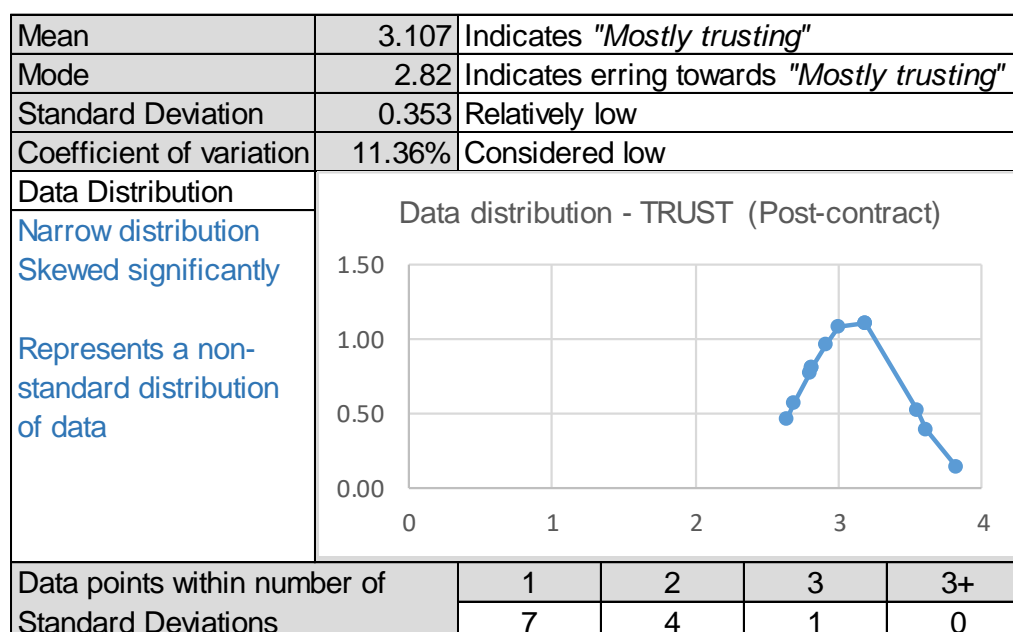
Observations

Even though this was prior to contract execution there was still a relatively high degree of trust amongst the parties. This reflects the comments from question responses that there was a *willingness* to trust. The skew and shape of the distribution shows this to be common between respondents.

What degree of trust do you have in each actor?

Three months following Contract execution

trust (POST): Individual scores response : *Figure D.0.6.2*



trust (POST): Individual reciprocal scores response : *Table D.0.6.2*

	Average score	Average difference	Average magnitude	Difference	Magnitude
CEC	2.91	-0.64	0.82	Less trust displayed	Mid-range difference
SPM	3.55	0.36	0.73	More trust displayed	Mid-range difference
PM1	3.18	-0.27	0.45	Less trust displayed	Minimal difference
LAr	3.00	0.45	0.64	More trust displayed	Mid-range difference
Arc	3.18	0.00	0.73	Neutral trust displayed	Mid-range difference
CSE	2.82	0.55	0.73	More trust displayed	Mid-range difference
BSM	2.80	-0.55	0.55	Less trust displayed	Mid-range difference
BSE	2.90	-0.82	0.82	Less trust displayed	Mid-range difference
CQS	3.82	0.09	0.27	More trust displayed	Minimal difference
CoL	2.69	0.27	0.82	More trust displayed	Mid-range difference
CPM	3.62	0.64	0.82	More trust displayed	Mid-range difference
CCM	2.82	-0.09	0.82	Less trust displayed	Mid-range difference

Observations

Following starting on site there was still a relatively high degree of trust amongst the parties. This reflects the comments from question responses that

there was a *willingness* to trust. The skew and shape of the distribution shows this to be common between respondents.

Comparative observations

The movement of key measures from the data between the two time frames could indicate general trend, in the following way;

Movement from Pre to Post Contract	
Mode	-0.18
Coefficient of variation	2.27%
Average score	-0.056
Average difference	-0.000
Average magnitude	0.364

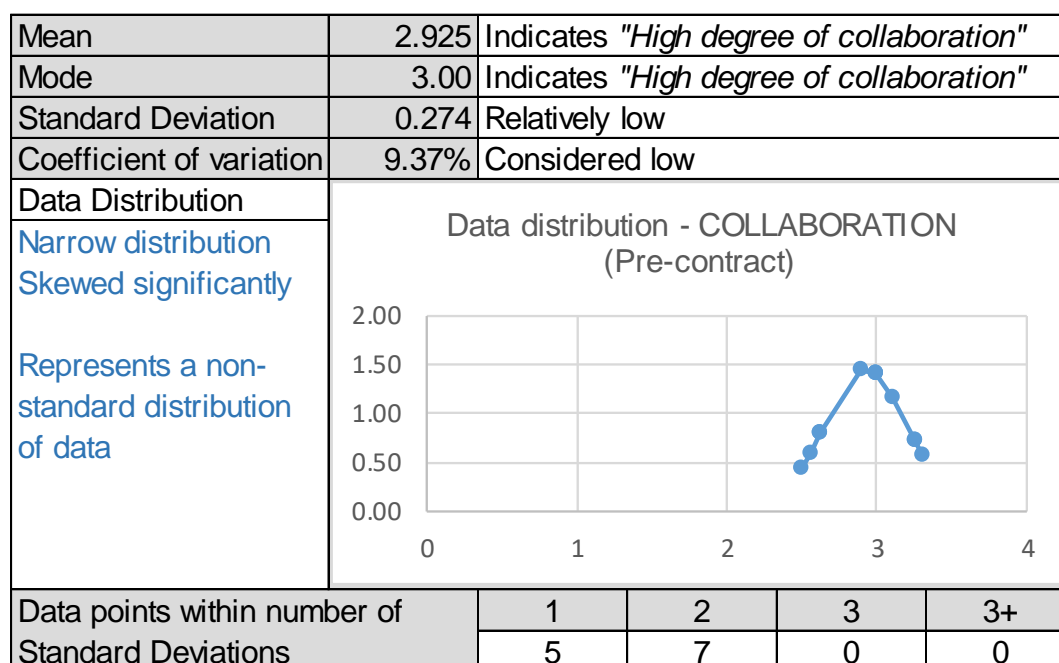
- *Mode decreasing*; lower trust scoring
- *Coefficient of variation*; an increased difference in degree of trust
- *Average score*; generally reduced levels of trust
- *Average difference*; minimal reduction in reciprocal scoring, less trust
- *Average magnitude*; increase in the variation of difference between reciprocal scoring, less reciprocally balanced trust

Generally, with the Contractor fully involved following contract execution, it appears that trust was slightly reduced and the range of individual actor's view on trust of the network were *broadened*.

What degree of collaboration is there with each actor?

Three months prior to Contract execution

COLLABORATION (PRE): Individual scores response : *Figure D.0.6.3*



COLLABORATION (PRE): Individual reciprocal scores response : *Table D.0.6.3*

	Average score	Average difference	Average magnitude	Difference	Magnitude
CEC	3.11	0.27	0.64	More collaborative	Mid-range difference
SPM	3.30	0.45	0.64	More collaborative	Mid-range difference
PM1	3.25	0.09	0.27	More collaborative	Minimal difference
LAr	2.56	-0.55	0.55	Less collaborative	Mid-range difference
Arc	3.25	-0.27	0.45	Less collaborative	Minimal difference
CSE	2.50	0.27	0.45	More collaborative	Minimal difference
BSM	2.63	-0.18	0.73	Less collaborative	Mid-range difference
BSE	2.63	-0.27	0.45	Less collaborative	Minimal difference
CQS	2.89	-0.18	0.36	Less collaborative	Minimal difference
CoL	3.00	0.64	0.64	More collaborative	Mid-range difference
CPM	3.00	-0.18	0.36	Less collaborative	Minimal difference
CCM	3.00	-0.09	0.09	Less collaborative	Minimal difference

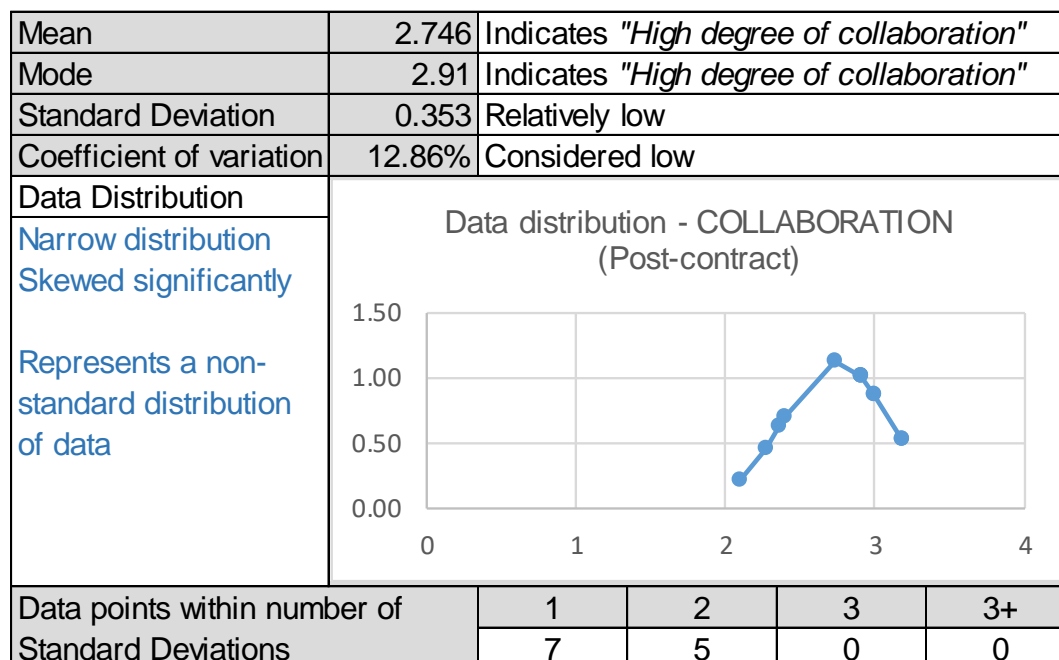
Observations

Even though this was prior to contract execution there was still a relatively high degree of collaboration amongst the parties (albeit a further interrogation of the data shows there was more amongst the Client team than with the Contractors at this stage) . This reflects the comments from question responses that there was an imperative to collaborate despite the contractual terms. The skew and shape of the distribution shows this to be common between respondents. It is observed that CoL indicates the highest average value indicating that they were more likely to collaborate, but the magnitude of difference indicates others had differing views of likelihood to collaborate.

What degree of collaboration is there with each actor?

Three months following Contract execution

COLLABORATION (POST): Individual scores response : *Figure D.0.6.4*



COLLABORATION (POST): Individual reciprocal scores response : *Table D.0.6.4*

	Average score	Average difference	Average magnitude	Difference	Magnitude
CEC	2.91	0.55	0.91	More collaborative	Mid-range difference
SPM	3.18	0.18	0.55	More collaborative	Mid-range difference
PM1	2.73	-0.55	0.55	Less collaborative	Mid-range difference
LAr	2.27	-0.45	0.82	Less collaborative	Mid-range difference
Arc	2.91	-0.27	0.64	Less collaborative	Mid-range difference
CSE	2.36	0.09	0.45	More collaborative	Minimal difference
BSM	2.40	-0.45	1.00	Less collaborative	Mid-range difference
BSE	2.10	-0.64	1.00	Less collaborative	Mid-range difference
CQS	3.18	0.09	0.45	More collaborative	Minimal difference
CoL	2.91	1.27	1.27	More collaborative	Significant difference
CPM	3.00	0.18	0.55	More collaborative	Mid-range difference
CCM	3.00	0.09	0.45	More collaborative	Minimal difference

Observations

Following starting on site there was still a relatively high degree of collaboration amongst the parties. This reflects the comments from question responses that there was a need to collaborate effectively, and the actors responded to that. The skew and shape of the distribution shows this to be common between respondents.

Comparative observations

The movement of key measures from the data between the two time frames could indicate general trend, in the following way;

Movement from Pre to Post Contract	
Mode	-0.09
Coefficient of variation	3.49%
Average score	-0.179
Average difference	0.008
Average magnitude	0.250

- *Mode decreasing*; lower collaboration scoring
- *Coefficient of variation*; an increased difference in degree of collaboration
- *Average score*; generally reduced levels of collaboration
- *Average difference*; minimal increase in reciprocal scoring, enhanced collaboration
- *Average magnitude*; increase in the variation of difference between reciprocal scoring, less reciprocally balanced view of collaboration action

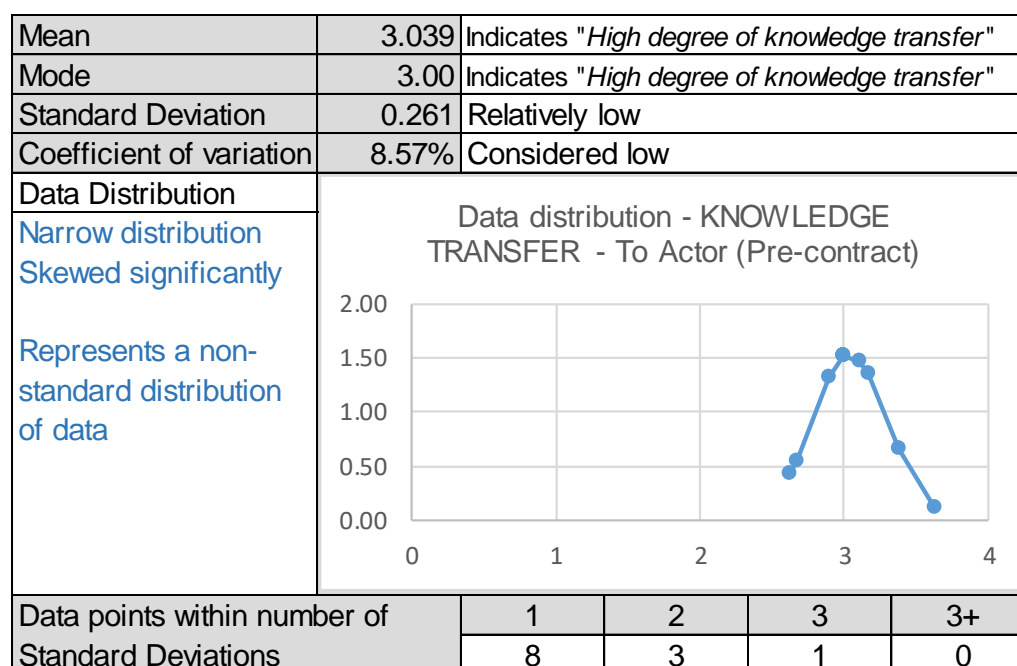
Generally, with the Contractor fully involved following contract execution, it appears that the view of collaborative action was reduced and the range of individual actor's view on network's collaboration were *broadened*. This may simply be a factor of the increase in network connections being made as the difference is small or might be that collaboration was further enacted by the actors.

What degree of Transfer of Knowledge is there with each actor - **To actor?**

Three months prior to Contract execution

KNOWLEDGE TRANSFER TO ACTOR (PRE): Individual scores response :

Figure D.0.6.5



KNOWLEDGE TRANSFER TO ACTOR (PRE): Individual reciprocal scores response : Table D.0.6.5

	Average score	Average difference	Average magnitude	Difference	Magnitude
CEC	3.00	0.00	0.36	More KT TO Actor	Minimal difference
SPM	2.90	-0.27	0.45	Less KT TO Actor	Minimal difference
PM1	3.38	0.18	0.36	More KT TO Actor	Minimal difference
LAr	3.00	0.00	0.18	Neutral transfer	Minimal difference
Arc	3.63	0.36	0.36	More KT TO Actor	Minimal difference
CSE	3.00	0.00	0.18	More KT TO Actor	Minimal difference
BSM	3.00	-0.09	0.09	Less KT TO Actor	Minimal difference
BSE	2.63	-0.36	0.55	Less KT TO Actor	Mid-range difference
CQS	3.11	-0.09	0.09	Less KT TO Actor	Minimal difference
CoL	3.17	0.55	0.55	More KT TO Actor	Mid-range difference
CPM	2.67	-0.18	0.55	Less KT TO Actor	Mid-range difference
CCM	3.00	-0.09	0.09	Less KT TO Actor	Minimal difference

Observations

It should be expected that in the period leading up to contract execution that there is a relatively high transfer of knowledge to other actors in the CLIENT network, and this is reflected in the data. There is also a significant amount of knowledge transferred to the Contractor network members.

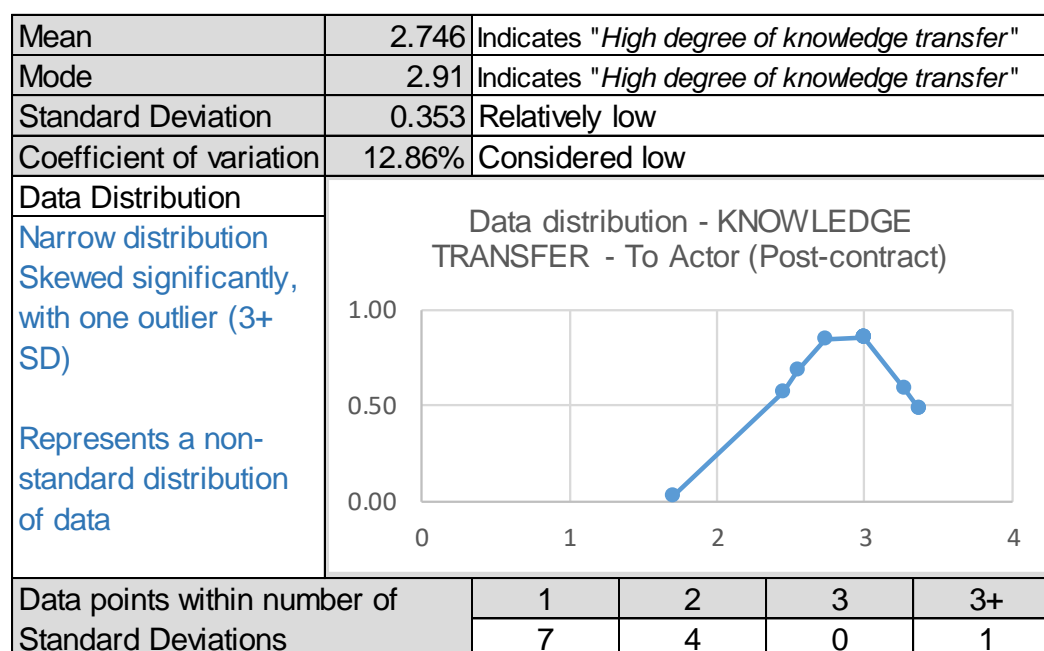
Notably, PM1 and Arc both score highly, representing more transfer of knowledge, which is largely agreed with by reciprocal scoring. This reflects the high degree of *technical* transfer that occurred on the project at that stage. The minimal difference in the magnitude represents the network members scored reciprocally to a greater extent.

What degree of Transfer of Knowledge is there with each actor - To actor?

Three months following Contract execution

KNOWLEDGE TRANSFER TO ACTOR (POST): Individual scores response :

Figure D.0.6.6



KNOWLEDGE TRANSFER TO ACTOR (POST): Individual reciprocal scores response : Table D.0.6.6

	Average score	Average difference	Average magnitude	Difference	Magnitude
CEC	3.36	0.64	1.00	More KT TO Actor	Mid-range difference
SPM	2.73	-0.27	0.45	Less KT TO Actor	Minimal difference
PM1	3.27	0.09	0.64	More KT TO Actor	Mid-range difference
LAr	2.55	-0.18	0.73	Less KT TO Actor	Mid-range difference
Arc	3.36	0.27	0.64	More KT TO Actor	Mid-range difference
CSE	3.00	0.18	0.18	More KT TO Actor	Minimal difference
BSM	3.00	-0.09	0.45	Less KT TO Actor	Minimal difference
BSE	1.70	-1.18	1.36	Less KT TO Actor	Significant difference
CQS	3.00	0.18	0.36	More KT TO Actor	Minimal difference
CoL	3.00	0.82	0.82	More KT TO Actor	Mid-range difference
CPM	3.00	0.09	0.64	More KT TO Actor	Mid-range difference
CCM	2.44	-0.55	0.55	Less KT TO Actor	Mid-range difference

Observations

As the project commenced on site there was a higher degree of knowledge transfer from the CEC to other network members and, alongside PM1 and Arc, they were the nexus of information sharing as construction activities commenced. The significant outlier in this data set is BSE; it is their opinion that they were not transferring as much knowledge as others' perceptions of same. The position of the building services subcontract is reflective of their scoring and, perhaps, has a relation to the *design feedback* required between designer and subcontractor for electrical systems.

Where it not for this outlier (albeit remaining valid) the data set would be distributed tightly albeit still skewed to a higher scoring position.

Comparative observations

The movement of key measures from the data between the two time frames could indicate general trend, in the following way;

Movement from Pre to Post Contract	
Mode	-0.09
Coefficient of variation	4.28%
Average score	-0.171
Average difference	0.000
Average magnitude	0.333

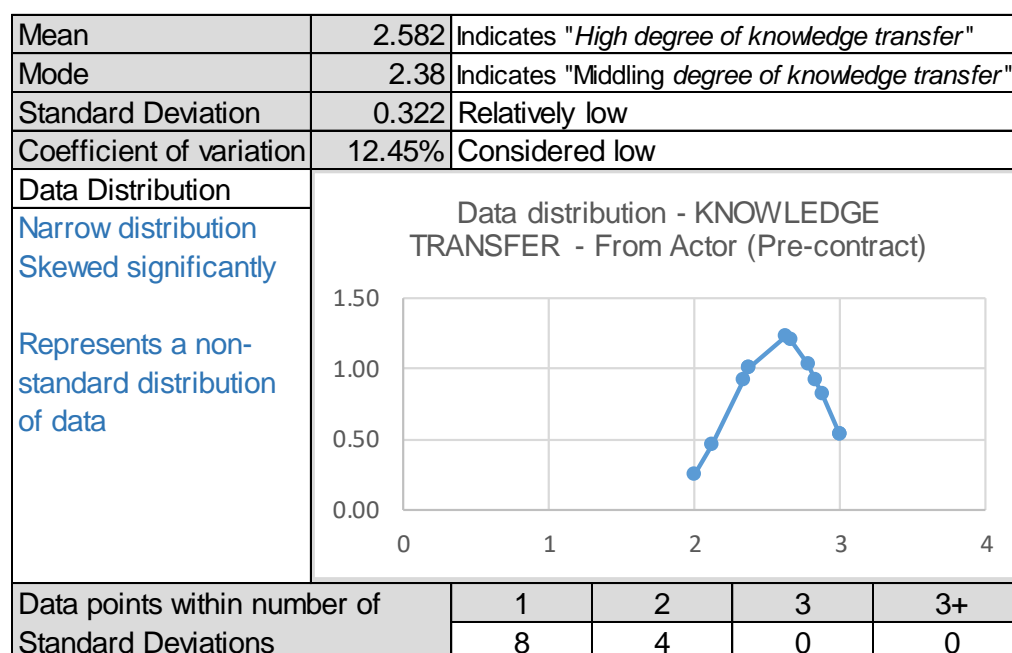
- *Mode decreasing*; lower Knowledge Transfer scoring
- *Coefficient of variation*; an increased difference in degree of Knowledge Transfer
- *Average score*; generally reduced levels of Knowledge Transfer
- *Average difference*; virtually no change in reciprocal scoring
- *Average magnitude*; increase in the variation of difference between reciprocal scoring, less reciprocally balanced view of Knowledge Transfer

The data is somewhat affected by the outlier scoring of BSE, but not significantly. The decrease in overall view of Knowledge Transfer TO other actors is likely a factor of increased network connectivity (Contractor team more central) and the outlier scoring.

What degree of Transfer of Knowledge is there with each actor - **From actor?**

Three months prior to Contract execution

KNOWLEDGE TRANSFER FROM ACTOR (PRE): Individual scores response
: Figure D.0.6.7



KNOWLEDGE TRANSFER FROM ACTOR (PRE): Individual reciprocal scores response : Table D.0.6.7

	Average score	Average difference	Average magnitude	Difference	Magnitude
CEC	3.00	0.45	1.00	More KT FROM Actor	Mid-range difference
SPM	3.00	0.27	0.64	More KT FROM Actor	Mid-range difference
PM1	2.38	-0.36	0.55	Less KT FROM Actor	Mid-range difference
LAr	2.33	-0.36	0.36	Less KT FROM Actor	Minimal difference
Arc	2.88	-0.09	0.27	Less KT FROM Actor	Minimal difference
CSE	2.13	0.45	0.45	More KT FROM Actor	Minimal difference
BSM	2.63	0.00	0.55	Neutral transfer	Mid-range difference
BSE	2.38	-0.18	0.36	Less KT FROM Actor	Minimal difference
CQS	2.78	-0.45	0.45	Less KT FROM Actor	Minimal difference
CoL	2.83	0.73	0.91	More KT FROM Actor	Mid-range difference
CPM	2.67	-0.18	0.55	Less KT FROM Actor	Mid-range difference
CCM	2.00	-0.27	0.27	Less KT FROM Actor	Minimal difference

Observations

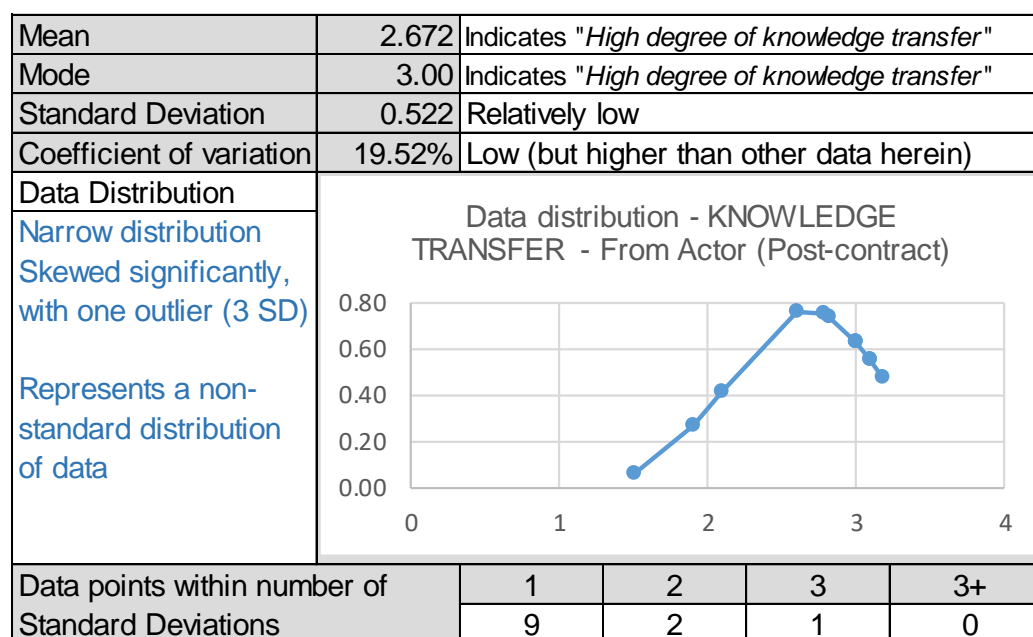
Whilst overall it appears the actors receive less Knowledge Transfer from the network (compared to how much they transmit), there is a noticeable higher scoring from both CEC and PM1. This reflects that the two positions of leadership acknowledge that the network is effective in provision of knowledge about the project. However, particularly for CEC, they perceive that they are getting more information from others than others are getting from them.

Within the data, there is a distinct outlying scoring partnership which will likely affect the data. CPM scores CoL as 0 whilst the reciprocal score is 4. This represents a significant difference in opinion of the relationship within the Contractor team.

What degree of Transfer of Knowledge is there with each actor - From actor?

Three months following Contract execution

KNOWLEDGE TRANSFER FROM ACTOR (POST): Individual scores response : *Figure D.0.6.8*



KNOWLEDGE TRANSFER FROM ACTOR (POST): Individual reciprocal scores response : *Table D.0.6.8*

	Average score	Average difference	Average magnitude	Difference	Magnitude
CEC	2.82	0.27	1.00	More KT FROM Actor	Mid-range difference
SPM	3.18	0.36	0.55	More KT FROM Actor	Mid-range difference
PM1	3.00	-0.18	0.73	Less KT FROM Actor	Mid-range difference
LAr	1.91	-0.73	0.91	Less KT FROM Actor	Mid-range difference
Arc	3.09	0.18	0.36	More KT FROM Actor	Minimal difference
CSE	2.09	0.09	0.82	More KT FROM Actor	Mid-range difference
BSM	2.60	-0.18	0.55	Less KT FROM Actor	Mid-range difference
BSE	1.50	-1.18	1.55	Less KT FROM Actor	Significant difference
CQS	3.00	0.00	0.73	Neutral transfer	Mid-range difference
CoL	3.09	1.09	1.09	More KT FROM Actor	Significant difference
CPM	3.00	0.36	1.09	More KT FROM Actor	Significant difference
CCM	2.78	-0.09	0.64	Less KT FROM Actor	Mid-range difference

Observations

The higher scores appear to be within the actor set of SPM/ PM1/ Arc/ CoL/ CPM/ CQS, those enacting the early aspects of contractual obligations and the transfer of requisite knowledge.

As with TO ACTOR, the significant outlier in this data set is BSE; it is their opinion that they were not receiving as much knowledge as others' perceptions of same. The position of the building services subcontract is reflective of their scoring and, perhaps, has a relation to the *design feedback* required between designer and subcontractor for electrical systems. Another slight outlier is LAr; this may reflect their position of slight distance as Architectural duties were handed largely to Arc.

Where it not for these outliers (albeit remaining valid) the data set would be distributed tightly albeit still skewed to a higher scoring position.

Comparative observations

The movement of key measures from the data between the two time frames could indicate general trend, in the following way;

Movement from Pre to Post Contract	
Mode	0.63
Coefficient of variation	7.07%
Average score	0.089
Average difference	0.000
Average magnitude	0.303

- *Mode increasing*; higher Knowledge Transfer scoring
- *Coefficient of variation*; an increased difference in degree of Knowledge Transfer
- *Average score*; generally increased levels of Knowledge Transfer
- *Average difference*; virtually no change in reciprocal scoring
- *Average magnitude*; increase in the variation of difference between reciprocal scoring, less reciprocally balanced view of Knowledge Transfer

The data is somewhat affected by the outlier scoring of BSE, but not significantly. The increase in overall view of Knowledge Transfer FROM other

actors could be due to the perception of good teamworking and collaboration that occurred as the Contractor team joined the network as generally reflected within the question responses.

When comparing the TO ACTOR to FROM ACTOR responses the following is observed.

	TO Actor			FROM Actor		
	pre	post	m'ment	pre	post	m'ment
Mean	3.04	2.75	-0.29	2.58	2.67	0.09
Mode	3.00	2.91	-0.09	2.38	3.00	0.63

Table D.0.6.8.1 Knowledge transfer comparison

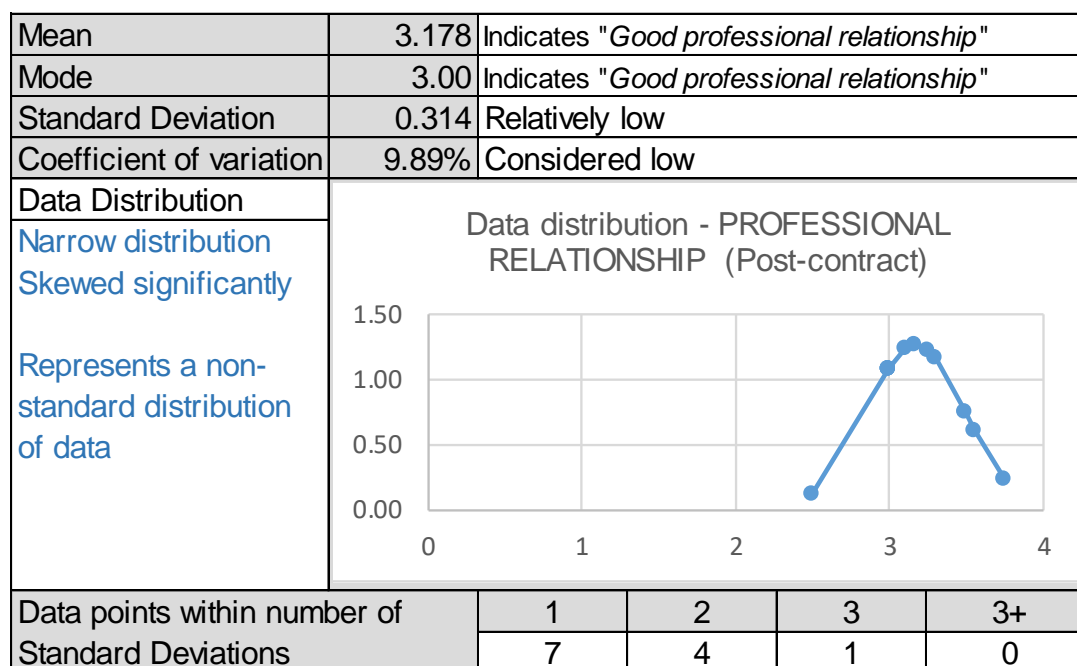
There appears to have been a perceived general *improvement* in Knowledge Transfer in the post-contract period FROM other actors, compared to a slight degradation in the TO other actors data set (which may be a factor of increased network connectivity in itself). Given the contractual arrangement within the project, this may be considered of interest; is it perceived that there were better communications in regards transfer of key knowledge from others? And should this be the case as the project kicks off and construction commences. Realistically the answer is “yes”, but it remains curious that similar actors perceive, however marginally, they are transferring less TO other actors, whilst receiving more FROM other actors.

What is the manner of relationship between yourself and each actor?

Three months prior to Contract execution

PROFESSIONAL RELATIONSHIP (PRE): Individual scores response : *Figure*

D.0.6.9



PROFESSIONAL RELATIONSHIP (PRE): Individual reciprocal scores response : *Table D.0.6.9*

	Average score	Average difference	Average magnitude	Difference	Magnitude
CEC	3.00	-0.55	0.55	Less positive	Mid-range difference
SPM	3.30	0.00	0.36	Neutral position	Minimal difference
PM1	3.75	0.36	0.55	More positive	Mid-range difference
LAr	3.11	0.18	0.18	More positive	Minimal difference
Arc	3.50	0.09	0.27	More positive	Minimal difference
CSE	2.50	0.09	0.64	More positive	Mid-range difference
BSM	3.25	-0.09	0.27	Less positive	Minimal difference
BSE	3.00	-0.27	0.27	Less positive	Minimal difference
CQS	3.56	-0.09	0.09	Less positive	Minimal difference
CoL	3.17	0.55	0.55	More positive	Mid-range difference
CPM	3.00	-0.18	0.18	Less positive	Minimal difference
CCM	3.00	-0.09	0.09	Less positive	Minimal difference

Observations

Reflective of the question responses the network actors appear to hold their professional relationships in high regard. The data outliers, if they can be referred to as such, are with CEC, CSE, and CoL. CEC noted a less positive response than their team members. CSE appeared to have a slightly higher opinion of their relationship with other actors, but an overall lower score than the rest of the network. CoL expressed a more positive view of relationships than other network actors.

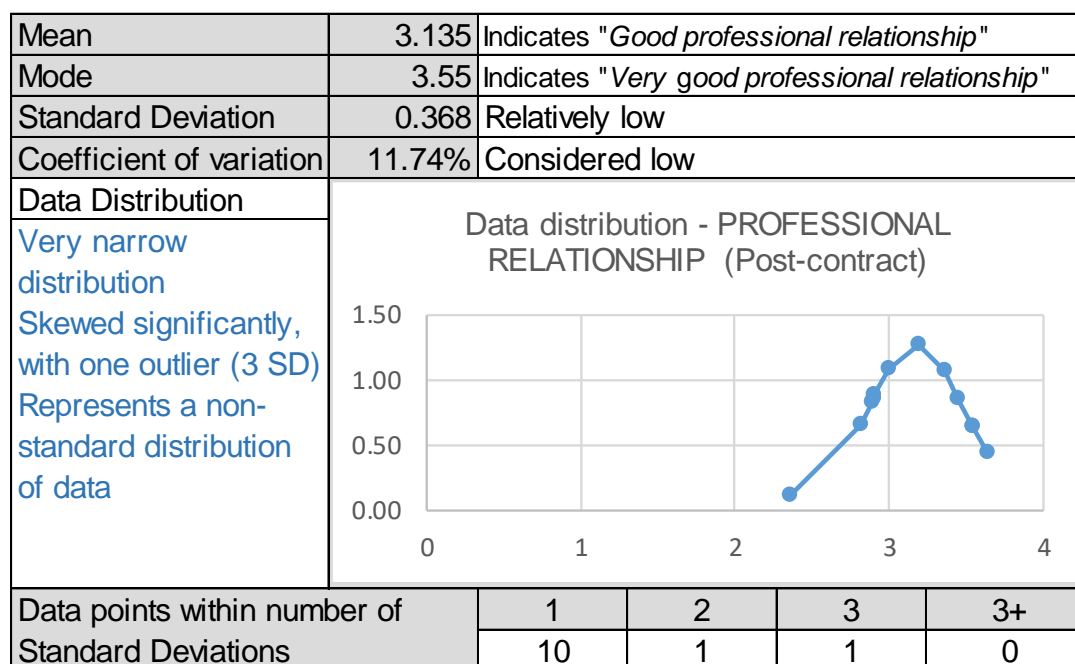
The two actors expressing the higher scores, PM1 and CQS, are the individuals who advocated the development of the *Collaborative workshop* prior to works commencing.

What is the manner of relationship between yourself and each actor?

Three months following Contract execution

PROFESSIONAL RELATIONSHIP (POST): Individual scores response :

Figure D.0.6.10



PROFESSIONAL RELATIONSHIP (POST): Individual reciprocal scores response : Table D.0.6.10

	Average score	Average difference	Average magnitude	Difference	Magnitude
CEC	2.82	-0.82	0.82	Less positive	Mid-range difference
SPM	3.36	0.09	0.27	More positive	Minimal difference
PM1	3.64	0.18	0.55	More positive	Mid-range difference
LAr	2.91	0.27	0.64	More positive	Mid-range difference
Arc	3.45	0.18	0.36	More positive	Minimal difference
CSE	2.36	-0.18	0.91	Less positive	Mid-range difference
BSM	3.20	-0.18	0.36	Less positive	Minimal difference
BSE	2.90	-0.36	0.36	Less positive	Minimal difference
CQS	3.55	-0.18	0.18	Less positive	Minimal difference
CoL	3.00	0.64	0.64	More positive	Mid-range difference
CPM	3.55	0.55	0.73	More positive	Mid-range difference
CCM	2.89	-0.18	0.36	Less positive	Minimal difference

Observations

Again, reflective of the collaborative approach and team ethos expressed within the question responses, there is a high scoring of the relationships within the network (MODE erring towards a score of 4, “excellent relationship”) and a close range of same. The notable outlier is the score of CSE which skews the distribution somewhat and reflects comments in question responses. CEC expresses a slightly lower score, and their view is, again, less than that of the teams working for them. CoL appears to have a higher regard of the relationships than the reciprocal scores.

Comparative observations

The movement of key measures from the data between the two time frames could indicate general trend, in the following way;

Movement from Pre to Post Contract	
Mode	0.55
Coefficient of variation	1.86%
Average score	-0.042
Average difference	-0.000
Average magnitude	0.182

- *Mode increasing*; higher scoring of the wider network
- *Coefficient of variation*; an increased difference in degree of view of relationship
- *Average score*; minimal reduction of scoring
- *Average difference*; virtually no change in reciprocal scoring
- *Average magnitude*; increase in the variation of difference between reciprocal scoring, less reciprocally balanced view of the relationships

The data is somewhat affected by the outlier scoring of BSE, but not significantly. The decrease in overall relationship view is likely a factor of increased network connectivity (Contractor team more connected) and the outlier scoring, as the narrative responses do not substantiate a degradation of the relationships.

D.0.7 Case Study Summary

This project benefitted from a number of factors; factors which may be considered at odds with the manner of traditional procurement that the project was subject to. Whilst it may have been expected to have been undertaken in a traditional, combative, manner rather than with collaboration at its centre, it was the case that collaboration and willingness to work together for a common goal afforded a positive outcome. This was evident in how the issues noted were ultimately dealt with, by seemingly consolidated efforts from the network. One of the central activities to this attitude towards collaboration was the early collaborative workshop with all leading members of the Network (excluding Building Services Subcontractor) involved; setting the scene and laying the foundations on expectations. There was also the benefit of prior connections, where actors within the network had previous, positive, experience of others from earlier projects. Add to this that there were a number of central actors who were continually championing collaboration, and it is evident that this project had positive influences at its core. Likewise there is evidence in the responses to the research that there was general positivity from the actors towards the Network, with little antipathy indicated in individual response.

On a commercial and corporate note, and something that is likely to have been a contributing factor, this project was the first new Primary School to be Designed and Procured from the Client's new frameworks. Apocryphally, there was the notion that all parties *HAD to make this one work* to engender positive response from the Client in order to be best placed for further work from the Frameworks, for both the Design and Client team and the Contractor. This may have had an impact on responses to contractual issues and behaviours then altered to suit. Direct evidence of this is not available, but a number of conversations around this aspect have been noted.

In terms of summarising the response to the over-arching research questions, table D.0.6.11 provides this.

Research Question topic	Case Study position
Levels of Trust	Defined as “Mostly Trusting”
Degree of Collaboration	A “high degree” of collaboration
Extents of Knowledge Transfer	A high degree initially, erring towards “middling” post contract(?)
Professional Relationship of the Network	Initially “Good”, then erring towards “Very Good” post contract
Client Objectives defined	Noted as being an “essential” requirement. Poor definition of objectives; success despite this
Building Services Procurement	Earlier involvement would have improved the project. Late appointment of Sub-contractor caused issues.

Table D.0.6.11 : Case Study position summary

D.1 Case Study 1 – Broomhills Primary School (BPS)



D.1.1 Case study outline

Broomhills Primary School, Edinburgh (BPS) is situated in the South-East of Edinburgh. It was to be a new school located in the midst of new private housing developments in the Frogston area. The School name was subsequently changed to *Frogston Primary School* prior to opening.

BPS was to be a 2-stream Primary school (7 years, 462 pupils) with a 60-place nursery included, along with extensive playground and landscaped areas and a new 7-a-side synthetic pitch for school and community use.

The CEC applicable Frameworks to this research: *As case study 0*

Following the perceived successes on SJPS the Client opted to maintain the majority of the same Client Team from that project. The exception being the Civils & Structural Engineers. The Landscape Architect (Sub-consultant to the Architect) was also changed.

At an early stage the approach to procurement was discussed and this was when the *Bespoke 2-Stage Traditional (with early Contractor input)* route was decided upon.

The Project development followed the RIBA plan of works through the design stages with all project team involved. Refer to Table D.1.1 for timeline and values. The team encountered design and budgetary challenges throughout this process, requiring design, risk, and value engineering responses. One of the issues being in original budget setting compared to scope and then further requirements being introduced; this placed additional pressure on the commercial aspects of the project. Programme was also a significant issue, given that the school was required to open in a timely manner to match adjusted school rolls for the area (hence the requirement for a new school). Despite the issues encountered the project went through a first stage tender process and Morgan Sindall (MS) were successful. The tender was based on Most Economically Advantageous Tender selection; the deciding factor in the outcome was the high Quality score that MS attained, as they were not the most economic.

Stage	Date	Value	Building Services %	Comments
Stage 2	13/10/17	£12,996,000	23%	Outline design which had significant architectural requirements
Stage 3	25/11/18	£13,466,000	25%	Developed design with Client additions
Stage 4	15/05/19	£13,491,000	28%	VE undertaken between Stages 3 and 4, including Contractor early input
Contract	18/07/19	£12,908,000	28%	Following full Work Package Market response
Completion / FA	28/06/21	£15,435,000	25%	Significant change, delay and other factors increase overall cost. MEP % reduction due to allocation of these change costs.

Table D.1.1 - Key milestones and values

The first stage engagement was then commenced with the full team coming together and programme for achieving “commercial close”, contract execution and site start outlined. The emphasis on Collaboration had been made throughout the Stage 1 tender process and was also reiterated at the initial meeting of the whole team. It stopped short of being a “workshop” as such (as Case Study 0), a point which was raised during the interviews; some felt an opportunity was missed here.

D.1.2 Notable events/issues in delivery

A number of events or issues that are relevant to the case study are included here .

- i. At the very outset of the Contractor Engagement, MS highlighted that they considered the development programme to be challenging, given the position of the design at this stage. They opined that this would mean potentially missing the milestone for agreeing contract and starting on site, which would then have a detrimental impact on the completion and handover dates. This opinion was not met well by the Client or Client side team and, as it was one of the first things noted by MS, set a negative tone which then echoed through other events. The review of the programme was part of the *Contractor Engagement* requirements. The fact that this led to a negative impression could be construed as a potential area of *mistrust* and had a detrimental affect on the approach to collaboration, which was central to the procurement method.
- ii. Alongside the programme issues, MS also noted that they considered that the budget would be inadequate in key areas of the design approach. They offered some suggestions for broad Value Engineering ideas which might assist aligning the budget. However, some of these items had already been discussed, and discounted, by the Client Team. At this stage it was commented that some of the ideas offered

by MS were “trying to cheapen the design”, though MS were attempting to redress the budget issues they perceived, in a collaborative way. Some members of the Client team, again, had a negative impression of this aspect, and this may have had an impact on their view of the collaborative approach thereafter.

- iii. There were a number of instances where the collaborative approach failed in the development process; instances where the team became significantly divided (Client / Contractor). They were in regards technical, programme, budget, and process issues. The situation is best summed up by the fact that the idea of including senior management actors into the *Project Management Group* was never enacted, keeping the contractor at arms-length. Not only did this go against the collaborative approach advocated, but it indicated to MS that they were potentially not been kept up to date of the entire project picture. This set the scene for subsequent collaboration failures during the project timeline, where the “us and them” ethos was clear, where *finger-pointing* was evident, where issues were not dealt with as one team, and where some significant challenges were not responded to appropriately because of this.

- iv. As aspects of the design did not progress effectively in line with the programme (most notably the MEP design) it became more apparent that the delivery programme was likely to be unachievable. MS were tasked to investigate a resolution to this and present options for consideration. They resolved that they would need to overlap some activities, set key design delivery dates (which would need to be adhered to), and also realign the work package procurement schedule to suit realigned programme. Broad agreement was met on this (despite some misgivings initially on the compressing design time available) and the process was enacted. It has been commented on in

interviews that, had MS not proposed this adjustment, the project would not have been able to start on site at a juncture to enable a completion date as required.

- v. A significant aspect of *iv* above was the MEP design position. This was noted as being behind programme and was where the most *stress* was encountered. However, given the approach whereby it was intended to fully collaborate with MS's MEP supply chain, there were alternatives discussed on how this could be resolved. The collaboration with the two MEP subcontractors as the design was still being developed was a positive experience for those involved and was also a positive for the project. The buy-in from the subcontractors to work with the team and review ideas for cost savings was effective given the design position and programme for contract execution. A resolution to the design / programme / Work package cost was ratified and meant that this did not cause a critical overall delay, however it did come with some risks in quantification for purposes of procurement.

- vi. The approach to procuring the Work Packages enabled the Commercial representatives to act in a more collaborative manner and the discussions and process of this was generally positive. The relationships between the commercial actors was noted as being generally positive. One of the issues that arose, however, was when the Contract Sum was presented for agreement to the Client Team; it was significantly higher than was understood throughout the process. The contract sum provided by MS was attempting to take account of a number of unknowns, risks and items for completion. The Client Team balked at the figure and viewed some of it as being opportunistic and "over the top". MS were advised to withdraw and review, as the value would potentially stop the project in its tracks. Here, there appears to have been a misalignment of expectations which was potentially a

factor of the degradation in collaborative attitudes. Ultimately, MS reviewed the Contract Sum, made some exclusions and the like and provided a Contract Sum that aligned more with Client expectations. This was supported by the Client commercial team, with supporting narrative on the level of Client Contingency required to align with the second proposal.

- vii. The design issues meant that attaining Building Warrant was delayed (even with a staged application). This was not improved by the Authority response to applications, and meant that, as the site commencement date approached, no warrant was in place. This induced risk as works should not start prior to this. Due to the Traditional contract approach, the risk of this remained with the Client, and MS required confirmation that they should commence at the Client's risk. This led to a degree of delay and was perceived negatively by the Client and Client-side team, with comments that *MS should have simply commenced*. It was another area where the collaborative approach was poor and degraded trust issues between some actors.

D.1.3 Section 1 – Interview Questions

1. Trust and project delivery

Q1.1 - In general, what is your view on trust and the role it plays in project delivery?

The respondents appeared to be largely in agreement with each other in that trust is considered “key”, “vital”, “significant”, and “critical” for successful delivery, and that “*it is essential for collaboration and for project delivery*”.

The lack of trust was expressed as being a root cause of issues within teams, failures or the inability to deliver successfully.

There was acknowledgement that trusting at the commencement of a project with new team members can prove difficult and particularly so when there is no previous experience of team members; *“It is one of the key things for project delivery. The lynch pin in relationships that get the job done successfully. But it’s also very difficult to ensure. It either exists or it doesn’t, it cannot be manufactured.”*

It was also expressed that *personality* has an impact on trust levels and even the willingness to trust, and that the construction industry can be problematic in this regard; *“Should be embedded throughout the process. Not everybody buys in to it. But that’s down to individuals, more than companies. So you get differing levels of trust and then engagement differs. Generally, what you tend to get in construction is people not trusting people.”*

Others commented on how, with trust, projects can move more efficiently, typified by; *“It’s vital, because unless there is trust things get slowed down. You’re always going to be checking on what was said and seeing if that’s correct or getting a second opinion. With trust you can move forward quicker with confidence.”*

Q1.2 - Specifically for this project, how do you think the level of trust between the actors had an impact on Delivery?

There was a general overall view that the levels of trust on BPS have had a negative impact, to varying degrees; *“It has had a huge impact on delivery. There is a lack of trust between a number of the actors and that has hindered our way of delivering.”*

Trust between the Client Team members appeared to be quite high and continued to be throughout, in the most part; *“level of trust between Design Team, Project Manager and Client is high... that contributed to the success of the project”*. Whilst trust between Client and Contractor teams started at a relatively high level, it was quickly diminished; though not entirely and not uniformly; *“I think it had some impact. I think there was a bit of mistrust even with the early contractor involvement and senior team, they were supposed to*

be in with the team early on. Always seemed we were fighting against them, kind of trying to prove why we've done what we have done". Representatives of both parties made suggestions that some actors were either not fully trustworthy or trusting. There was allusion to a blame culture in certain areas; "From a design perspective, there's been a lot of "blame", instead of working together and trusting what each other are saying". As issues arose the fragility of the trust relationships became apparent; "It was significant. Expectations from other actors were maybe higher than they should have been, which meant in some interactions that some actors were adopting a protectionist position leading to less trusting collaboration".

Specific comments made on the MEP supply chain involvement; *"by bringing in the two supply chain members, there is already a level of trust with them, I think that had a benefit to what we were doing"* and *"We have needed to have a fair level of trust with who we have dealt with. And I think there has been a high level of trust in those smaller circles."*

Q1.3 - Specifically for this project, what level of trust do you think was active between the actors?

There were varying views on the levels attained and how these levels changed as time progressed. Some commented that there was "strong trust" between certain Client-side actors, but this wasn't the same for the entire team; quite the opposite, with one comment stating, "There is inherent mistrust between contractor and everyone else", albeit this opinion was not widely articulated. Conversely other observations on this link, mirrored the assertion; *"There appears to be no trust in the contractor from the Client team"* and *"It seems that the architect and the Client have less trust in the contractor than others in the team"*. This then may highlight a fundamental issue, no trust between key members of the network; trust relationships that *should* be the bedrock of the team; *"I think it's coming from the top and that has caused a lot of wasted effort. A lot of angst and frustration has been*

generated. A large degree of the mistrust between Client and contractor has been stoked by that.”

Another observation was made, saying there *“was a medium level and it fluctuated depending on conditions throughout the process”*, which reflects other observations within the case study that, when things became problematic, trust levels were diminished. This was observed as being *“dependent on the individuals”*.

Specifically regarding the trust within the MEP elements of the network, the observations were positive, partially due to the existing professional relationships between Designer, Contractor and Sub-Contractor; *“Even with the limited interaction our position had allowed, there has been a good level of trust, and there hasn’t been any issues. The process undertaken meant that we felt like part of the team”*

2. Trust and knowledge transfer

Q2.1 - In general, what is your view on the role of trust in the transfer of Project knowledge?

Generally common view that it has some importance on the process, with descriptions such as *“essential”, “significant” “high impact” and a “huge element”*. There was a number of responses stating that is definitely required to ensure the process of knowledge transfer is efficient; *“The two go hand in hand. No trust, no transfer of knowledge”*, in order for actors to be able to *“know that the knowledge they are getting and are relying on is correct, reliable and coordinated”*. This was partially echoed by others, one example being *“Knowledge and experience plays a part in trust. Clients rely on competence and capability of contractors based on their experience as well”*.

One comment of interest specifically noted that this aspect of Trust may be a *one-way* issue *“I think it probably has an impact on how it’s received rather than how is transmitted”*, which seems to infer that trust isn’t as essential for knowledge to be provided. This echoes general comments but does not

necessarily reflect the reciprocity aspect of Knowledge Transfer. It was commented that trust can not and should not be *imposed*; *“As for individuals, there has to be a degree of trust to work, but you do need to carry out your due diligence. You cannot blindly trust; you have to ensure there is the right competence etc.”*

Q2.2 - Specifically for this project, how do you think the level of trust between the actors had an impact on the transfer of key knowledge?

Whilst the team was noted as being significantly experienced in this regard there were issues highlighted in the responses, and differences in opinions. Whilst some stated that there was a high level of trust and that *“the whole team trusted in the knowledge being provided”* as well as *“a high level of communication between all actors throughout the engagement including the collaboration activities”*, others were not so positive about the trust levels. This is best summarised by one comment *“At various points there has definitely been a lack of trust between the Client team and contractor, and that means the knowledge transfer has been affected due to reluctance to believe in what we are being told. I’m not sure some parties trusted the process of knowledge transfer itself”*. The differing views in themselves could be seen as problematic; *“There was good trust between the commercial actors and that helped. From the design perspective there was a lack of trust and that meant limited transfer of key knowledge”*.

The project for this case study, being the first of the three projects was impacted most as in the following two projects benefitted from an understanding of where the knowledge transfer could be better.

On specific aspects related to the Building Services; *“Those involved in that aspect worked really well with a number of really useful meetings to set the scene of knowledge passing. Having 2 subcontractors in the discussions may have had a negative effect on trust levels, but generally it worked quite well in this regard”*.

Q2.3 - Specifically for this project, how effective was the transfer of key knowledge?

The general response in this area was that the effectiveness differed between actors, and that a lack of effectiveness was particularly notable at the interface between Client team and contractor. It was also commented on that there were instances when the knowledge that was being transferred was not being utilised effectively (rather than the transfer itself being effective); which might indicate a lack of trust in either the transferer or the knowledge itself.

The comments ranged from *“It was good. The timing of the transfer may have been somewhat problematic for some members of the team. Where timing was poor, this did have an effect on effectiveness and of productivity”* to *“I don't think it was effective at all. People wanted to listen to what they wanted to listen to”*.

Again, it was considered more *“challenging”* on this project, being the first of the three projects in the cluster. So, as an exercise overall, the issues encountered in effectiveness on this project may ultimately have had a positive impact on the wider team(s).

There was also an observation from one respondent, who also noted the differences in effectiveness, on how *external factors* also had an influence on the effectiveness in this context; *“In parts very good between certain parties. But also, with some parties it has been quite poor. Where it has been poor, I think that this has been driven by external factors, external Client factors and external stakeholders. They have had a negative influence on how we have been able to communicate effectively.”* This contends that even when considering the subject within a network there are always likely to be externalities that are placing pressures on individuals and organisations within the project network, as well as the network itself.

3. Differing inter-actor perception of trust

Q3.1 - In general, what is your view on the perception of differing levels of trust between construction project actors, and how this affects inter-project relationships?

There was general agreement between the respondents that differing perceptions of trust levels between actors would have an effect on relationships between parties. Comments generally stated that relationships would “suffer” where there was disparity. One actor noted *“with construction having people 100% at its centre, any disparity in trust levels between people would be detrimental”*; this sums up the trend in the comments for the actors.

There were a number of comments on the nature of the levels of trust in the industry generally; *“you trust, you’re open, you’re free with communications, but you’re always holding something back. And I think that is just an inherent mistrust within the industry. This has improved significantly over the time I’ve been in the industry, but it’s still got a long way to go.”* And how this then impacts on the nature of collaboration; *“You’re not going to give everything away, you’ve got a job to do, and we are not going to give everything away. Is that how we really should be working? Is that true Collaboration? Probably not.”*

There was also a comment in regards how perceptions can have an influence on the way that individuals trust, as well as references to how previous experiences with team members can set the trust agenda; and that this may mean the project is doomed from the outset.

Q3.2 - Specifically for this project, what is your view on how different perceptions of the levels of trust between actors affected relationships?

There was a mixture of comments to this question, and they are reflected in responses elsewhere on the Network’s relationship. Respondents were, in part, quite candid about their trust position. One commented *“There is potentially some disparity between myself and the contractor. Whilst originally, I was willing to trust them, events in the first stage then started to erode my*

trust in them, and whether they trusted me equally or not, that erosion causes issues.” And whilst some had a view of a “very balanced project” others were quick to note that there were plainly imbalances in the trust levels, and that the trust was misplaced. The aspect of the procurement approach and the collaboration aspiration was also commented on, in that “I don't think there is any collaboration now and we have reverted to Traditional” and that “there have been some instance when issues have been probably made worse by mistrust between parties”. Others noted that trust was degraded but mused “I’m not sure it has had that much of an effect. Even though there is a degradation of trust, it seems to have been somewhat mutual and so the relationships have mutually worsened. And I think the collaboration anticipated didn’t happen because of this degradation.”, which is somewhat scathing of the network generally in this aspect. This view is repeated in that; “Some parties were extremely cynical towards others in the team, and this was extremely detrimental to project relationship.” And that this might have been the position from the earliest part of the interaction with the Contractor; “I think it has had an impact and from very early on – really strained relationships between contractor and design team. The Contractor team was maybe a little inexperienced on the traditional approach and this has led to a bit of a trust issue. The lack of understanding has had an impact on those trust levels.”

Q3.3 - Specifically for this project, to what level do you think any disparity in trust levels affected the outcomes of the Project Delivery?

Responses given (albeit that a lot of respondents felt they had covered this in Q3.2) highlighted that project delivery had been affected by the trust levels and the potential disparity; *“There was definitely disparity evident. And it did have an impact on outcomes. This was evident within the design knowledge transfer etc. The expectations were not clearly defined or achievable and so, once delivered, the mismatch in understanding affected the trust relationships across the contract.”*

Some also commented that it was unlikely to get better and so the out turn for the project would probably be significantly impacted. *“It has had an affect; a significant affect. The impact is that the trust levels are reduced and collaborative ways to resolve things go out of the window. Contractual mechanisms before we have even discussed any issues. This plainly comes from an eroded trust relationship, and maybe that works both ways.”* Others noted that it might not be the “disparity” *per se* that will ultimately affect outcomes but simply the lack of trust across the network; *“I don’t think the disparity matters. A relationship will default to the lowest level of trust that is there, and deal on that basis. The weakest link really”* And others noted that, as this project was the first of the 3 projects, that this one was bound to be worst in this regard; hoping for improvement in the follow on 2 projects.

In regards the Building Services engagement; *“I think at the start there was a disparity in how the MEP designer viewed the supply chain. They appeared a little unsure of their involvement. So that might have had an impact. But at the end of the process the relationship seemed to have improved, which indicates the trust levels being better and the outcomes being favourable.”*

4. Client definition of objectives

Q4.1 - In general, what is your view on how the Client defining their key value objectives affects performance delivery?

As with Case study 0, there was consensus between respondents stating that defining the objectives is “essential” or “Critical”. There were numerous comments relating to it being “clear that the Client needs to be definitive on budget, programme and quality from the outset”, providing “a clear, definitive objective”; and that a “clear Client brief means a better running project by and large”.

Other comments along the same lines; *“This is very important that the Client defines them clearly and early enough. Not doing that has a detrimental impact on delivery.”* And on the subject of keeping the clear brief in mind

throughout the project; *“Clients need to make it clear what they primarily want; TIME, COST or QUALITY. They usually want all three but there should be one of those indicated as the primary requirement or key driver. Its key and needs defining clearly from the outset, so it’s always in the team’s mind when things are being considered.”*

Q4.2 - For this project, what were the Client's value objectives and how were they defined?

It was apparent from the responses that there was a degree of confusion around the definition of the objectives; *“I have absolutely no idea what the Client value objectives were; they weren’t defined to me in any clear way”*, which in itself is representative of the situation. Some believed that at a higher level it was quite clear what the Client wanted; 3 schools for key delivery dates. At a more detailed level it becomes less clear. *“I would say there was a lack of documentation on these requirements; no Authority’s Requirements document or anything like that. That has been detrimental and that’s not good enough.”*.

When changes were then required, this invoked further confusion and this was reflected by the respondents; *“The changing requirements were communicated unofficially and sometimes quite badly, with no structure for effective communication. And sometimes it felt there was no pattern, nor rhyme or reason. It was sporadic and hap hazard”*.

In regards what were the key objectives and confusion around these; *“the Client focused on Time and Cost and that sometimes interchanged. I wasn’t aware that Quality was ever a real factor”* and *“I think Programme was absolutely key at one point, but then Cost became a big issue. Quality must have been in there somewhere, but not really clearly defined I don’t think.”*.

Comment was made on the *“Contractor’s Client Charter”*, but this was only mentioned by 2 members of the network in this project. It appears that there was very little knowledge of its existence (including the researcher). *“The Client’s key objectives were QUALITY and collaboration. They were defined*

through the contractor's Client charter which was driven by the contractor from the outset."

This was sought from the actor who initially mentioned it (refer figure D.1.a); it is of note that of the objectives mentioned by the network generally only *collaboration* and *quality* appear in the charter. No mention of value for money nor of programme.



Figure D.1.a : "Customer Charter"

Q4.3 - Specifically for this project, what is your view on how the Client's communication of value objectives have affected the team delivery?

The majority of the responses were quite negative in how this had an impact on the team delivery. The lack of clarity was “*detrimental*” and there were comments on how the manner of communicating requirements ultimately slowed the project down during the development period as different actors had different expectations. “*It slowed the delivery down and made the delivery much more Stressful. More antagonistic if you know what I mean*”.

Along similar lines “*At one stage it was intimated that if the budget wasn't met then the project would not proceed, so obviously COST was key at that point. How truthful that was, I can't comment. But this then put pressure on the collaborative approach we had been taking up until then; a more traditional view was then taken*”.

Another commented on the confusion and the burden this places on the delivery team; “*I think there have been some mixed messages from the Client at times in terms of the value objectives, and that's put real pressure on the team. I think we have gone from a QUALITY led approach to a PROGRAMME lead issue with COST as a secondary. Then COST has been the prime issue with PROGRAMME taking a step back. I get that, there are pressures from elsewhere that drive this, but that means the project team have to react differently at different times.*”

Q4.4 - Specifically for this project, how do you think the manner of Client's communication of value objectives has impacted on the approach to collaboration between the delivery team?

Common thread in the answers in that it is recognised by virtually all respondents that the collaborative approach advocated HAS been affected by the manner of this communication; “*At some stages the collaboration seemed to simply fall away, with communication only being through the PM. That's not how the collaboration was anticipated to work; it should have had all of us working in the same direction and all at the table.*”, BUT it is not the only factor

(Trust issues already commented on). The Client representative themselves acknowledges this himself; *"We know what we NEED, but we don't know what we want is the best way to describe this"*. Mirroring this, one comment was *"whilst our team has been collaborative, the delivery team, the Client side has been pretty poor. I think that the lack of a definitive document and the way we've procured this, has made that collaboration less effective"*. Another was quite clear in this regard; *"It has been one of the factors, but the changes in what were the Clients prime objectives, (programme, cost, programme, quality...) was a factor in itself. We were all given a bit of the run-around at times. And that definitely affected how we collaborated"*.

One of the Design team commented, somewhat more pragmatically; *"The design process has not been effectively collaborative, there has been some individualism inherent. But then that's not unusual. Collaboration with the contractor? I'm not sure if the manner of communication has had an impact or not on that approach."*

But another commented on how the lack of clarity caused re-work as well as tension within the team; *"not knowing clearly what we were all aiming for, what direction we were going caused enhanced tensions between the team members. This also leads to abortive decisions, which again heightens any issues between those already in a tense relationship."*

5. Collaboration and Building Services

Q5.1 - In general, what is your view on how collaborative procurement of building services affects project outcomes when measured against "Client defined value requirements"?

There were mixed responses from the network on this aspect and some were quite precise and related to their role. One response started with *"Do we really consider what the Client's values are when we procure MEP...?"*.

A number commented on the significance of the MEP package within projects; *"MEP is always one of the main packages and whatever you do has an*

impact on projects. Anything you can do to assist that process must be a positive”.

The balance of the responses are reasonably positive towards the question. Some examples are; *“The idea of collaborative procurement is a good idea. Could do to take it wider than MEP. It should, if it works, affect the project outcome positively... if you know what the Client value targets are”* and *“It SHOULD be positive. It should improve Knowledge Transfer, project understanding, end goals of MEP design and clarity. The journey should improve mutual outcomes rather than saying here’s what I want, now go and deliver it”*

In tempering this generally positive view, one further comment which did not share quite the same level of positivity; *“I do think this is one area where I have seen good collaboration and, as a personal view, I do think that MEP designers over the last 10-15 years have been pushed towards, through design and build and other procurement routes, Performance type specification and not actually the nuts and bolts of delivery and installation. However this might not be always a good thing as design responsibility is somewhat a grey area or can be. But in principle, if it is done correctly and collaboratively it should provide a better outcome in regards Client value and in terms of costs and programme, but those involved have to know what they are doing and work well together”*

Q5.2 - Specifically for this project, how would you describe the approach to collaborative early engagement with the Building Services supply chain?

There were distinctively different responses to this, and this was due to some of the network not being aware of the collaborative workshops undertaken between MEP designers, Main Contractor, MEP supply chain, and commercial teams; *“I’m aware that there was some engagement with the MEP supply chain as part of the procurement approach, but that’s about all I can comment on. Not sure how effective it has been”*

This is not necessarily a negative, but the fact that collaboration was a central requirement of the process it may have been of benefit if the entire team were, at least, aware; *“Not really aware of what went on in this area, but I get the sense there was some good engagement pre-contract”*

From those involved in the collaboration, again there was a mixed response, some thought it was not as effective as it could have been; *“Probably a missed opportunity here. It was too traditional in this instance. Whilst the budget and programme were most pressing issues when we engaged with supply chain, it might have been more effective to have broader dialogue to get better results. Earlier engagement would have been even better, allowing more time with the supply chain and the benefit of their knowledge”,* others considered it served a different purpose; *“I’m not sure there was much design collaboration as such, it was, at that point more about Value Engineering. About saving money more than a fundamental improvement on how we do the job. I’m not sure it really worked in filling gaps or of coordination of other works; certainly not to the extent we hoped it would be. There was no real benefit.”*

Others had a more positive view on the engagement, if only partially; *“I think actually these projects, from what I saw, It went well relatively. Well initially. I think generally it went quite well, it’s unusual to get a Client who asks who would you run with? The other thing to touch on, I think the fact that we had two contractors both actually interacted despite them being in competition against each other. The value engineering session that we did; the two of them both came up with suggestions. You would not normally get that at all; especially when you have two main contractors in that position. There’s no way they would give the other ideas. I thought that was an unusual one”,* and others on the timing of the engagement; *“I think it was good, but maybe a bit late. The design information was a bit behind where it needed to be. We managed though to close out the big and obvious issues in the engagement but there was always going to be some issues given the design position.”*

Q5.3 - Specifically for this project, what effect did the approach to collaborative early engagement with the Building Services supply chain on delivering to Client defined value requirements?

Even though the collaborative engagement process did not involve all parties there was generally a positive response to the outcomes of the process; *“The pre-agreed items with the MEP subcontractor has actually helped in coordinating other aspects of the design – so that was good. But again, how that aligns with Client defined value requirements... hard to say”*.

The comments revolve around the problems arising from the MEP design position against the challenging programme and that, without the involvement of the supply chain, the delivery would have been extremely difficult. An example being *“The collaborative early engagement made the delivery a possibility. Time was key. Its restrictions have had effects on other project aspects. But KT was good and the incorporation of that has benefitted the projects”*. And that the engagement had benefits in other ways; *“It was successful. It allowed supply chain to look at alternatives and have input on potential better value options, whether they are taken by the Client or not. But it also gives the subcontractor an opportunity to get ahead of the game too... and that benefits the project.”*

Further to the programme pressures, in regards the impact of the nature of the Client requirements; *“The early MEP subcontract engagement should be able to drive value into projects. But here it was sort of limited by the Client Requirements. The earlier the better in this activity to get the benefit of expertise.”*

One of those involved in the engagement felt somewhat differently (which also reflected a comment made in Case Study 0 in regards which design discipline should take the lead); *“Not effective really. It would have been better if we could have had a collaboration earlier (Stage 2 maybe?); a real collaboration where the services approach can alter the overall building design. But the aesthetic and the Client requirements over-rode a degree of other problematic design issues. There were some architectural and structural elements which*

caused more problems with MEP design and having earlier input may have resolved that. But MEP is generally a secondary design thought and has to be fitted in to what is already designed. Where there is a high reliance on MEP there is an argument that a more MEP centric design ethos should be adopted, and I'm not sure the Client would be defining their values based on MEP. There is a lack of overarching and informed design/technical Client who can make calls on the trade-off between aesthetic and practicality, which has a potential impact on value and cost."

Q5.4 - Specifically for this project, in what way was the collaborative approach taken towards the Building Services Supply Chain effective?

Mixed views from those who provided an answer in addition to Q5.3; whilst some thought it *"seemed to have a positive affect"*, others had concerns on what it meant to other's deliverables – *"Probably not effective because I think that the two stage approach almost helped others fail. It sort of relieved the responsibility of design away from the designers, which lead to a further "foot off the gas" attitude because someone else would do it"*. But generally speaking, in this area, there appears to be general positivity, as can be noted from other responses, such as; *"It was effective. Early cost advice and quicker to deal with cost issues. And because of that, and other technical discussions, I think the relationships are stronger because of what we did. There is also a degree of buy in from the MEP supply chain and so more responsibility on them to deliver as part of the team."*

On the relationship between Designer and Supply Chain members; *"What has been good is, due to the small pool up here to work from, the MEP designers know the supply chain, and so there are pre-existing relationships. That plays a part in its success. Open and honest approaches from all parties. And I think the Client has got ADDED VALUE from the approach taken."* And on the position of the design when the engagement occurred; *"I think it assisted the MEP designer as they were a bit behind, but the discussions we had clarified some aspects and assisted their design. Also the VE approach was of benefit*

at that stage, even though the Client rejected some big items.” Which was further noted by other, lengthier, responses

One aspect was criticised by one of the actors involved in the engagement in regards personnel;

“It was the commercial representatives of the MEP subcontractors that came to meetings rather than those who would be on site etc. This obviously means it’s a cost driven exercise rather than a technically lead exercise. Which limits true collaboration on design and delivery.”

6. Collaborative Procurement Approach Effect

Q6.1 - In comparison to the pilot case study (SJPS) Project (or others if not involved in SJPS), in what way did the alternative procurement approach taken affect this project?

As a collective it appears that the majority of the responses feel that it should have had a positive impact on the project *“In principle this procurement method should tick all the council's boxes. The early budget setting, the engagement, and the out-turns should all be exactly what CEC are looking for. But... in reality it’s not worked, and my view is that it’s mostly due to the contractor not coming to the table as much as they should have. In addition to that I think the design issues haven’t helped, the design delivery programme initially was too optimistic and since then there have been gaps highlighted”,* but that what has transpired has not met aspirations in regards collaboration, adding value, or effective delivery; *“I’m being entirely honest, I don’t think it was 100% successful. I think there was good things about it, in the building services approach, but I think there was just too much done, the job was too far down the line for us to actually influence. We were too late to the party.”*

There were expressions of disappointment from some members of the network; *“I don’t think it’s delivered any real benefits. I think from the Contractors involvement point of view it hasn’t. Even when they were looking at alternative specifications, I think it was purely cost driven and that the*

alternatives were not equal at all. This take a lot of time and can be frustrating. And I don't see any benefit that we achieved through the two stage approach."

Views differ from individual parties and there is an element of *finger pointing* and *blame-laying* from some; indicative of how relationships have not been as effective, as trusting, or as collaborative as hoped. It was recognised, by some, that if this procurement approach had not been adopted the projects would not have been able to align with programme aspirations; *"The approach, I think, made the two main objectives (time and budget) possible. Without it, we would have been unlikely to meet the initial programme at all. At the point of engagement the programme was unachievable, and we had other factors affecting the ability to deliver (planning etc.). Real collaboration, avoiding duplication of effort and the like, simply hasn't happened. Not that people were avoiding undertaking their obligations but seemed that there were missed opportunities to use the supply chain in a better way. An alternative procurement might have been even earlier engagement and perhaps a D&B route, as the traditional aspect has been problematic."*

However, a number of responses reflect the (sometimes very) personal view of the affect of this procurement selection; *"If we had gone down a traditional route with performance of Design team and the performance of the Client team in terms of defining requirements and changes, we would have been looking at significant claims. So I think for the wrong reasons it was right. We got the right result by going this route. In terms of others. I am always amazingly disappointed by two-stage contracting."*

One actor commented that the process should have worked as it has been done before and, whilst it had not been perfect, there were benefits to the follow on projects; *"This approach could have worked much better – WE (all of us) could have done a lot better. This isn't a particularly unusual approach. Some do this collaborative approach on an open book process because the trust is there. It's not been quite like that on these projects, and it could have been so much better. There will be benefits from what we have worked*

through on BPS to the other two projects... because we have largely the same team. That's a positive I suppose." And another talked of the benefits that had been generated, even though commercial concerns might have got in the way; *"Because of the first stage there were benefits on project knowledge for the contracting team at an earlier stage. But I think we missed a trick because of the programme pressures we had to get an agreed COST quicker than we maybe should have. In doing that, we did not get the potential benefits of further market testing, or soft tendering, that we could have got."*

Q6.2 - How did the collaborative procurement approach advocated affect trust between project participants?

There appeared to be the *belief* that it *should* have had a positive affect on the participants; *"I think that there should have been enhanced trust due to the procurement route but then things that happened within the early engagement had an impact on trust levels. And whilst that not might have induced distrust, it certainly was an erosion of trust which we never got back. Some people in the team outright distrusted others, there's no denying that."*, but the responses by and large point to either it having little or no affect or actually inducing issues in this respect; *"Plain and simple - Awful! From very early on in the stage 1 process there seemed to be a lack of engagement and therefore the collaboration was affected. There were key instances when Trust was tested and ultimately it wasn't there between multiple actors within the procurement. Individually and at corporate level."* And *"I think trust is probably lower. So even though we're supposed to have this collaborative approach, my view is that we've got lower trust levels in these projects."*

There were also some comments on how some of the network were active in trusting relationships and that those actors also were also collaborating to a higher degree; *"I think it had a positive effect on some parties. Some key relationships were very good and it worked really well; a high level of trust. But in other areas, not buying in to the process fully, it was less positive."* As a network however, it is clear from the responses that trust was diminished or

absent and the collaborative model *may* have been a factor in this; *“The collaborative approach has been a bit of a mixed bag I think. I think some of the collaboration has allowed some trust relationships to flourish, but others have been made worse by some of the confusion over when and how the collaboration was taking place.”*

The nature of individuals and personality was commented on by a number of the actors; *“Potentially different characters may have had a more trusting approach and that may have been of benefit. But that’s about personalities and their view of how the industry works. “Us and Them” – Contractors and Client etc. some people still think this is or should be the norm.”* How this impacted on the network trust levels; *“Because of specific personalities involved the collaborative approach. This detrimentally affected trust levels.”* And how this may have been dealt with at an earlier stage; *“Initially the trust aspect was strained. It was clear from very early on. I think we missed a trick in putting on something like a workshop to build the team, build the trust. That’s what we missed at the beginning. We were told we were collaborating, but we didn’t fully know what that meant.”*

The role of the project leadership in the arrangement was also commented on; *“I think it forced us to try and trust one another. But asked the question, “what comes first the collaboration or the trust?” You need to have a level of trust from the outset and that has to be set. Leadership is required in this, and it has to cascade down the way”,* and also how the imposition of time and cost pressures also made the task more difficult, alongside leadership and personality issues; *“I’d like to say it helps trust being built... But in reality, the pressures placed by budgets and costs on a project has a significant impact on trust relationships. Characters in the team also have an effect on outcomes and that’s the case here too. Some senior leadership actors have been problematic and caused trust relationships to be put under stress. **It’s all about personalities really**”.*

Q6.3 - How did the collaborative procurement approach advocated affect delivery to "Client defined value requirements"?

Responses were very much personal and potentially related to roles within the network; so a mixed response. If we take the 19 network members and review their responses in the context of either "positive" or "negative", there were 9 seemingly positive views (so just less than 50%). With 1 response being non-committal, which means that there was an equal amount of seemingly negative views. What this then indicates is that individuals' perceptions of the impact of the collaboration are likely to relate to their role in their network, their approach to collaboration, and their experience within the project and network.

Some key *positive* comments from these responses include; *"I think it probably was Positive. In that the team were able to work, get work arounds. The contractors worked hard to deal with the Clients change by being engaged. I think there were a lot of times they were trying hard to work around that."* One comment noted that they felt it might not have been achievable by doing it differently, but that the process required enhanced inputs; *"It made it possible in my eyes. But the journey has been too problematic, harum-scarum stuff at times. It's been a route that required more trust of the actors, which has not always been there. The collaboration approach SHOULD enhance outputs, but the levels of trust and engagement need to be high and are essential for success."*

Another comment regarding an area of the team which did appear to work well within the model; *"The Commercial side has worked quite well together, and I think that is unusual. Probably worked better than the construction/design side. I think that's where the highest trust levels and better collaborations are."*

Less positive comments included; *I don't think it's helped in any way. I don't think the Contractor felt the need to push the design team to make changes for the project benefit... UNTIL it suited their methods or supply chain, or commercial position."* And that cost and programme pressures were key in

failure; *“I don't think it worked. I think it fell apart once it was realised the budget was going to be an issue and time scales were going to be an issue.”*, which aligns with expectations noted by; *“I'm not sure the Client has got what they were expecting from this collaborative approach, and maybe that's to do with their expectations.”*

More pragmatically, some commented on some of the side effects of the process, in regard to commitment and quality outcomes; *“I'm not sure the Client recognises what benefits he has had from the approach taken. There have been challenges but there is no doubt on the commitment from all parties to deliver. There is a better communication approach adopted because of how this is set up, and that's at all levels.”*

General Comments provided by respondents

The opportunity was afforded to those interviewed to provide general comments on the subject matter (others are noted in Appendix C).

On the general approach and the actual outcome being *personality* influenced; *“This is leaving a nasty taste in the mouth and whilst the procurement route is probably taking the brunt of that, it is probably not fair to say that. In theory, it should have worked, but it's come down to personalities, both individual and corporate. The culture on the projects has degraded from when we started; the trust had been eroded and I'm not sure how we could have kept that given what went on.”* And *“I generally think it was a good idea. It was an unusual idea, to go for traditional type Contract with collaborative approach in it. It would have worked had everyone bought in to it.”* A further comment was made in regards how central individuals are to collaboration; *“Having done a few collaborative projects successfully, I'll tell you this; It's not down to organisations or companies; it is down to individuals to work collaboratively. It's how they are; open, honest, trustworthy. If they aren't natured that way, they won't be able to work like that, and won't be able to be trained to do it. It's down to personality.”*

On specific issues within the collaborative approach and how the idea of collaboration seemed to disappear; *“My thoughts are that we should have been more forceful on deliverables from both the contractor and the design team during the first stage. We should never have gone into contract without all things in place as it was a massive risk (Building warrant), but the programme pressures dictated this. That was our main mistakes. Post contract execution it seems that the idea of collaboration has been parked and everyone has reverted to really traditional roles - I don’t see collaboration anywhere.*

And finally on the view of Clients on procurement generally; *“Like with many Clients there’s no procurement which meets all their requirements exactly. You can’t have quickest, cheapest, high quality, low risk from a singular procurement route... something normally has to give...”*

D.1.4 Section 2 - The Network structure

The structure of the network being studied is expressed graphically and, in relation to key Social Network Analysis indicators, in numeric form. The two aspects considered are the *Network density* (a comparison of potential nodal links to that enacted within the network), and the *centrality* of the individual actors and as a collective.

The two key time frames of the study are represented (the 3 months prior to contract execution and the 3 months immediately following) and comparisons drawn.

Three months prior to Contract execution

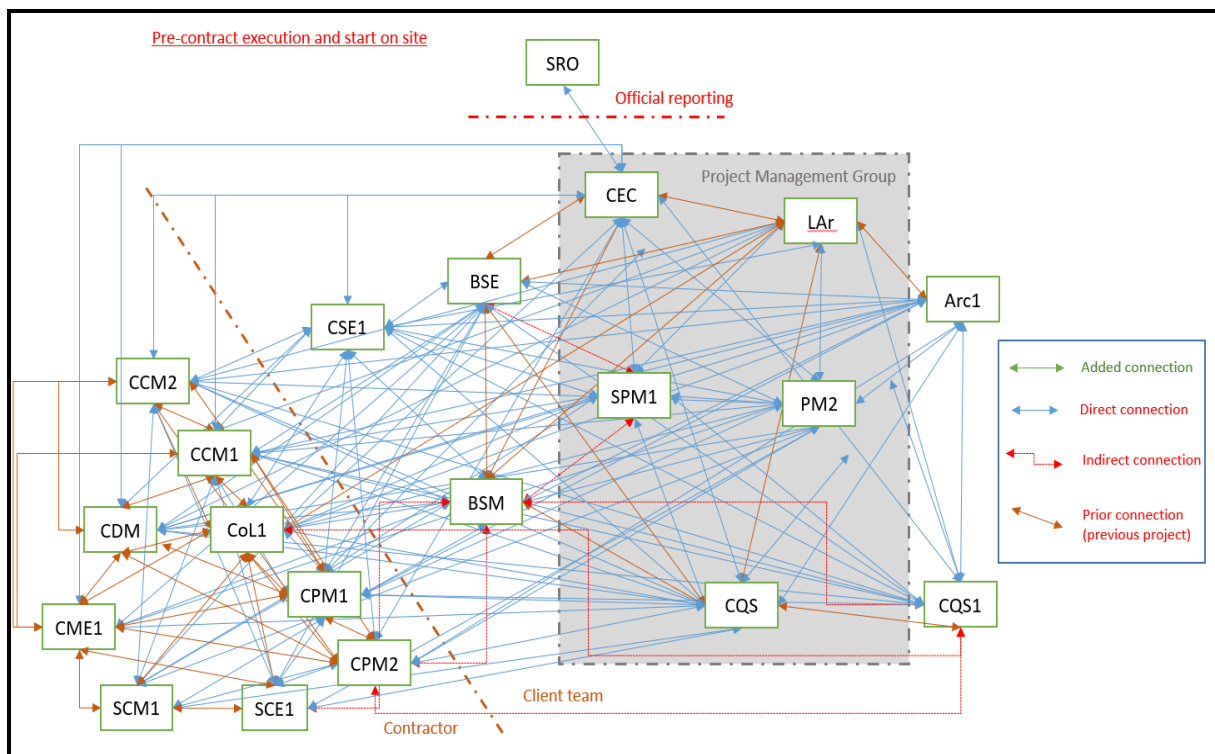


Figure D.1.1 : SNA diagram – BPS, Pre-contract

Figure D.1.1 shows a quite well interconnected network with a number of connections that were already existing (previous projects and the like). The *busy-ness* of the network reflects how there was a high degree of interaction at this stage, including a number of connections that are noted as being via another actor. The Project Management Group (PMG), which was the core of

the Client team and project decision makers, members are situated in the grey shaded area, with *some* of the actors being the same from Case Study 0.

Network density

Number of nodes	19
Total Number of potential links	171
Number of links present	129
Network density	0.754

The network density shown here indicates a density of just below 75%.

This reflects the interactional nature of the pre-contract obligations of the Stage 1 collaborative engagement and the *busy-ness* of the network. That it is not higher reflects a number of the network believing they were distant from some other members. Looking at the data behind this the significant areas of lack of connectivity are between the Contractor and Sub-Contractor MEP representatives (CME1, SCM1, SCE1) and the members of the Client team not directly involved in MEP design.

Centrality

Each actor's centrality score is noted along with a graded scale (green indicating high, red indicating low). A spread of those actors with the highest centrality, from both Client and Contractor's teams. The most significant are CPM1 and CCM1 who were driving the Contractor's engagement with the team, followed by CQS and PM2, who were the leading actors from the Client side. Reflecting comment above on the Network Density, CME1, SCM1, SCE1 score the lowest (understandably) along with SPM1. This may indicate that whilst PM2 was leading the Project management aspects, the Senior PM representative was seen as distant or not as central to the network interactions. The relatively high centrality of the overall network and the

Client	CEC	0.833
	SPM1	0.639
	PM2	0.917
	LAr	0.833
	Arc1	0.833
	CSE1	0.806
	BSM	0.861
	BSE	0.889
	CQS	0.972
	CQS1	0.750
Contractor	CoL1	0.889
	CPM1	1.000
	CPM2	0.806
	CCM1	1.000
	CCM2	0.917
	CDM	0.917
	CME1	0.639
	SCM1	0.583
	SCE1	0.528
	Average centrality	0.822
	Client Average	0.833
	Contractor average	0.809

balance between Client and Contractor average centralities should represent an active network with good communication lines.

Whilst centrality is generally referred to for individual actors within a network, the averages are included here for comparison to the second timeframe.

Three months following Contract execution

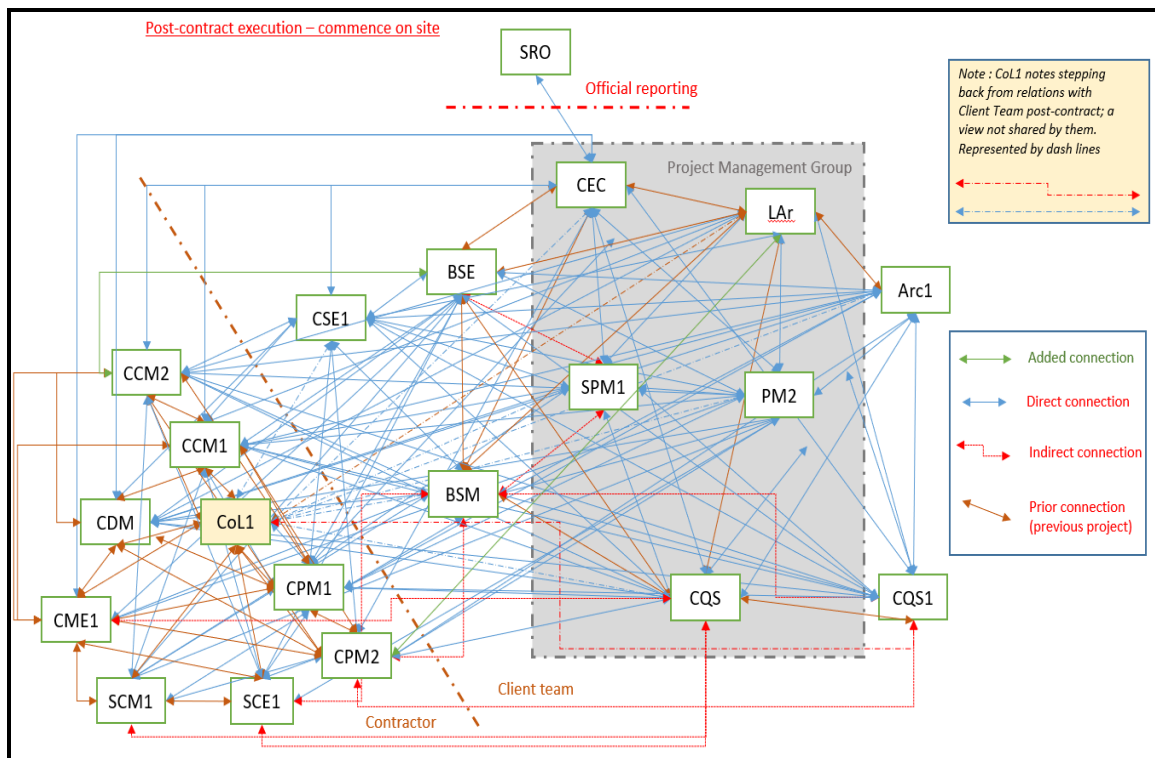


Figure D.1.2 : SNA diagram – BPS, Post-contract

Figure D.1.2 is in the same format as the pre-contract version, but then reflects the changes noted from the network responses. The most notable is that CoL1 noted that he believed he stepped away from the network (from the Client side at least) once the Contract was executed. Whilst this might have been his perception, Client actors in the network still considered him being involved. Another item of note is that the direct link between the Client commercial actors and the MEP Subcontractors was diminished, being via others.

Network density

Number of nodes	19
Total Number of potential links	171
Number of links present	110
Network density	0.643

The network density shown here indicates a density of just below 65%, a marginal reduction from the pre-contract period observed. This is reflective of the comment from CoL1 (reduction in present links) and the link degradation of the MEP subcontractors.

Centrality

Client	CEC	0.806
	SPM1	0.611
	PM2	0.889
	LAr	0.694
	Arc1	0.806
	CSE1	0.778
	BSM	0.778
	BSE	0.806
	CQS	0.861
	CQS1	0.694
	CoL1	0.611
Contractor	CPM1	1.000
	CPM2	0.806
	CCM1	0.972
	CCM2	0.889
	CDM	0.861
	CME1	0.667
	SCM1	0.500
	SCE1	0.500
	Average centrality	0.76462
	Client Average	0.772222
	Contractor average	0.756173

The two most central actors in the network remain the Contractor's Construction and Commercial leads (CPM1 and CCM1).

The general downward trend of the centrality scores may be a factor of CoL1 being less positive towards his position in the network as others view, but it is also a reflection of the noted degradation of some relationships and the approach to the collaboration. Arguably however, centrality should have, at least, remained the same, as in the period post contract execution there should have been a similar level of collaboration to ensure the project progressed. The slight reduction in scores could also be reflective of

the more traditional approach that ensued once the (traditional) contract was enacted. In regards leadership, the two senior leadership actors (SPM1 and CoL1) score relatively lowly; could this be a factor in the effectiveness of the network in continued collaboration?

Comparative comments

The change between the two timeframes, it could be argued, *should* not have happened given the collaborative approach was advocated to be undertaken

throughout the entire project. The reality is that the both the density and the centrality are affected by the relative positioning in two key areas;

CoL1 and their “stepping back” from the network

SCM1 and SCE1 and their direct connectivity with the Client commercial network members.

The scoring still represents a reasonably active and communicative network; the question is then around its effectiveness. This will be addressed by the responses from other aspects of the SNA questions.

Network Density and Centrality

The two measures of a networks connectivity and activity are summarised here for the two periods considered.

	Network Density	Centrality
3 Months prior to Contract	0.754	0.822
3 Months after Contract	0.643	0.765

Scored responses to SNA questions

It should be noted that, unlike Case Study 0, the two MEP sub-contract members of the network (SCM1 and SCE1) are included within this element of the study as they were present throughout the period of research.

In regards the outline of questions posed, scoring methodology and outline analysis and comparison; this remains the same for all case studies and can be found in this section of Case Study 0. It is not repeated here.

D.1.5 Relative Importance Index

RII general outcomes

The data is summarised in table D.1..2 and figure D.1.3 to show the average RII response to the SNA questions for both Pre-Contract and Post-Contract periods. The shift in RII is then indicated to express if the actor had a more positive or negative view between the two periods.

	Average RII response		movement	
	Pre-Contract	Post Contract		
CEC	0.57	0.60	0.03	same or more positive
SPM1	0.77	0.74	-0.03	less positive
PM2	0.72	0.74	0.02	same or more positive
LAr	0.71	0.59	-0.12	less positive
Arc1	0.71	0.68	-0.03	less positive
CSE1	0.72	0.65	-0.06	less positive
BSM	0.77	0.77	0.00	same or more positive
BSE	0.73	0.70	-0.04	less positive
CQS	0.80	0.71	-0.09	less positive
CQS1	0.71	0.67	-0.04	less positive
CoL1	0.77	0.88	0.11	same or more positive
CPM1	0.89	0.90	0.01	same or more positive
CPM2	0.72	0.74	0.03	same or more positive
CCM1	0.87	0.89	0.02	same or more positive
CCM2	0.78	0.76	-0.02	less positive
CDM	0.71	0.70	-0.02	less positive
CME1	0.73	0.73	0.00	less positive
SCM1	0.95	1.00	0.05	same or more positive
SCE1	0.95	1.00	0.05	same or more positive
Average	0.77	0.76	-0.01	less positive

Table D.1.2 : Overall RII responses

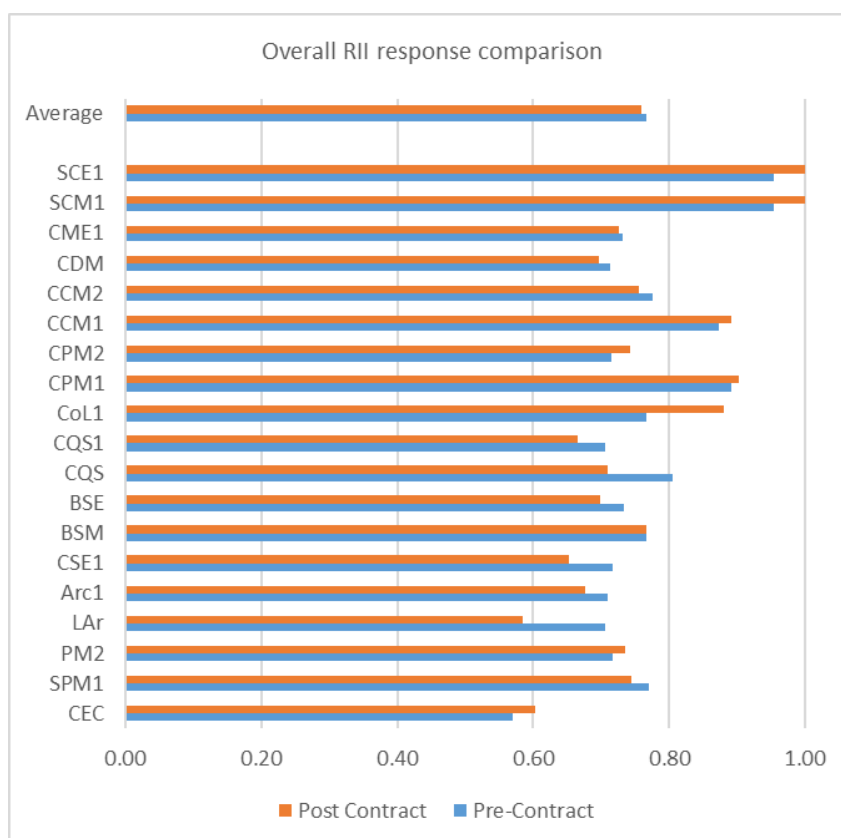


Figure D.1.3 : Overall RII response comparison

This indicates that the overall view was less positive, albeit marginally. There are however some notable observations. Again CoL1's response is more than likely slanted due to his view of who he is scoring in the post-contract period (largely those from his own organisation). Those from the Client team, generally, have a less positive view of their scoring, some (LAr and CQS) indicating a circa 10% reduction in positivity towards the network; is this reflective of the design and commercial issues that arose around contract execution? The Client (CEC) noted that they believed the pre-contract period to be more problematic than immediately after contract execution, but his scores are both relatively low; this reflects his view of the procurement's performance. The Contractor's leadership members of the network seemed to marginally improve their view on scoring, but this could be that the pre-

contract period proved problematic in their view, and they were more positive about delivery than previously.

RII data distributions

Table D.1.3 show that, using the RII measure, the data is a mixture between “normal” and “*not normal*” distributions, and this is reflected in the individual data analysis that follows. This does not represent an issue but has to be recognised in the data analysis. It is a factor of the data being collected from actors who express *very personal* views within the context of the SNA questions, and particularly in certain question areas. The two questions that elicit a “normal” distribution both pre- and post-contract, through this measure, are in regards how each actor views Trust and the transfer of knowledge FROM other actors. This then suggests a more balanced view of the network, from the actors; it may reflect equally levels of trust (or lack of) and a similarity in how each actor perceives the transfer of knowledge from others in the network (positively or negatively). Collaboration is split from a normal distribution pre-contract to a not-normal distribution post-contract. This might reflect the difference in opinion in how the two periods compare from different actor’s points of view. This will be further narrated in the individual response to follow.

		within 1 SD	average range from SD	distribution
TRUST	Pre-contract	68%	0.80	normal
TRUST	Post-contract	68%	0.79	normal
COLLABORATION	Pre-contract	68%	0.84	normal
COLLABORATION	Post-contract	63%	0.86	not normal
TRANSFER OF KNOWLEDGE TO ACTOR	Pre-contract	63%	0.85	not normal
TRANSFER OF KNOWLEDGE TO ACTOR	Post-contract	63%	0.83	not normal
TRANSFER OF KNOWLEDGE FROM ACTOR	Pre-contract	74%	0.78	normal
TRANSFER OF KNOWLEDGE FROM ACTOR	Post-contract	68%	0.82	normal
PROFESSIONAL RELATIONSHIP	Pre-contract	63%	0.82	not normal
PROFESSIONAL RELATIONSHIP	Post-contract	58%	0.83	not normal

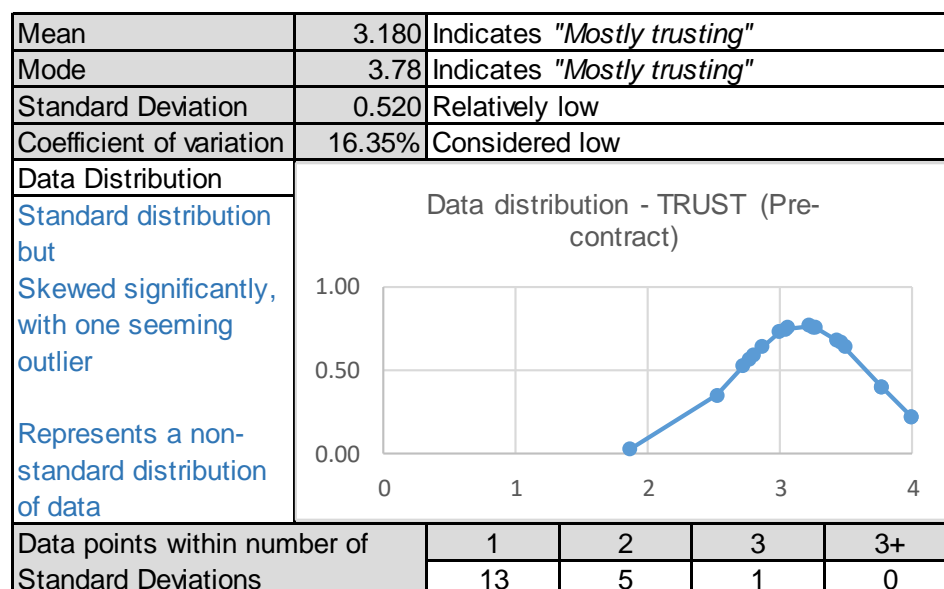
Table D.1.3 RII data distributions

D.1.6 SNA Questions outcomes

What degree of trust do you have in each actor?

Three months prior to Contract execution

Trust (PRE): Individual scores response : *Figure D.1.6.1*



Trust (PRE): Individual reciprocal scores response : *Table D.1.6.1*

	Average Score	Average difference	Average magnitude	Difference	Magnitude
CEC	1.88	-1.11	1.11	Less trust displayed	Significant difference
SPM1	2.77	-0.56	1.11	Less trust displayed	Significant difference
PM2	2.72	0.28	0.83	More trust displayed	Mid-range difference
LAr	3.07	0.00	0.56	More trust displayed	Mid-range difference
Arc1	2.80	-0.17	0.94	Less trust displayed	Mid-range difference
CSE1	3.47	-0.06	0.61	Less trust displayed	Mid-range difference
BSM	3.06	-0.06	0.83	Less trust displayed	Mid-range difference
BSE	3.27	-0.56	1.22	Less trust displayed	Significant difference
CQS	3.28	-0.50	0.61	Less trust displayed	Mid-range difference
CQS1	2.87	-0.83	0.83	Less trust displayed	Mid-range difference
CoL1	3.22	0.56	0.89	More trust displayed	Mid-range difference
CPM1	3.78	0.50	0.50	More trust displayed	Minimal difference
CPM2	2.53	-0.17	0.83	Less trust displayed	Mid-range difference
CCM1	3.78	0.61	0.61	More trust displayed	Mid-range difference
CCM2	3.44	0.72	0.94	More trust displayed	Mid-range difference
CDM	3.00	-0.33	0.67	Less trust displayed	Mid-range difference
CME1	3.50	1.11	1.44	More trust displayed	Significant difference
SCM1	4.00	0.28	0.39	More trust displayed	Minimal difference
SCE1	4.00	0.28	0.39	More trust displayed	Minimal difference

Observations

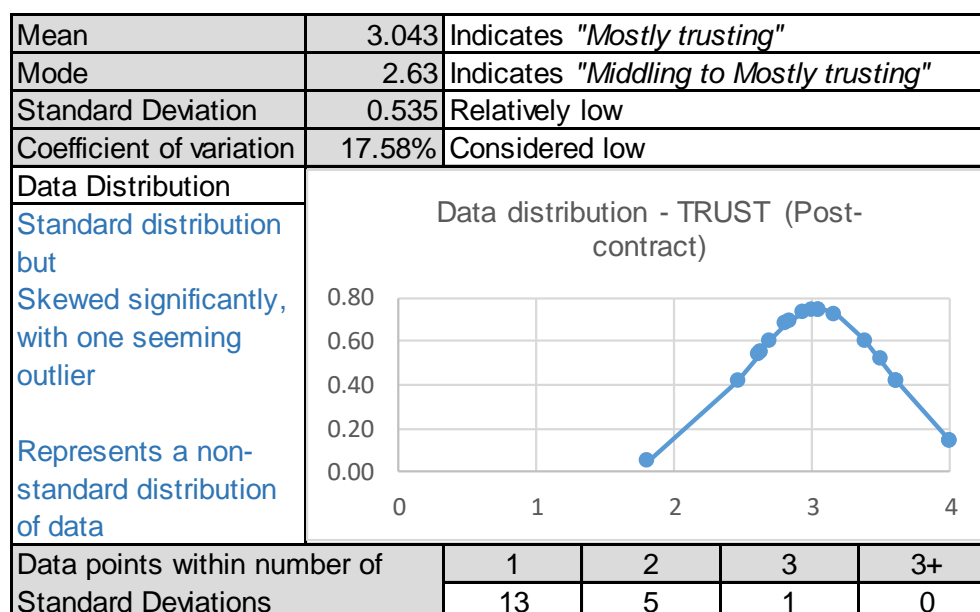
The out turn is that the respondents *mostly trusted* the network, albeit there are a number of factors in this; CEC scored significantly lower than the rest of the network whilst SCM1 and SCE1 scored relatively higher (highest). This could be due to their limited network connectivity, with those who they felt most able to trust. Interestingly the view of the network (however limited) of trusting them was very similar, unlike the reciprocal view of CEC by others. This also impacts the *co-efficient of variation*.

CME1 also indicates a significant difference but it is observed that she notes more connections to others than are reciprocated, hence higher difference and magnitude.

What degree of trust do you have in each actor?

Three months following Contract execution

Trust (POST): Individual scores response : *Figure D.1.6.2*



Trust (POST): Individual reciprocal scores response : *Table D.1.6.2*

	Average Score	Average difference	Average magnitude	Difference	Magnitude
CEC	1.81	-1.00	1.11	Less trust displayed	Significant difference
SPM1	2.62	-0.39	1.17	Less trust displayed	Significant difference
PM2	2.83	0.67	1.00	More trust displayed	Mid-range difference
LAr	2.63	0.11	0.89	More trust displayed	Mid-range difference
Arc1	2.47	-0.28	0.83	Less trust displayed	Mid-range difference
CSE1	2.63	-0.28	0.61	Less trust displayed	Mid-range difference
BSM	3.06	0.78	1.00	More trust displayed	Mid-range difference
BSE	3.06	0.56	1.00	More trust displayed	Mid-range difference
CQS	2.94	0.11	0.89	More trust displayed	Mid-range difference
CQS1	2.81	-0.39	0.72	Less trust displayed	Mid-range difference
CoL1	3.50	-1.50	1.50	Less trust displayed	Significant difference
CPM1	3.61	0.39	0.72	More trust displayed	Mid-range difference
CPM2	2.69	-0.39	0.72	Less trust displayed	Mid-range difference
CCM1	3.61	0.67	1.00	More trust displayed	Mid-range difference
CCM2	3.17	0.50	0.94	More trust displayed	Mid-range difference
CDM	3.00	-0.39	0.83	Less trust displayed	Mid-range difference
CME1	3.39	0.94	1.39	More trust displayed	Significant difference
SCM1	4.00	-0.06	0.67	Less trust displayed	Mid-range difference
SCE1	4.00	-0.06	0.67	Less trust displayed	Mid-range difference

Observations

Not a dissimilar outcome from pre-contract with some obvious exceptions; CoL1 being one, due to his view of his stepping back from the network which is not reciprocated. CME1 indicates a similar significance to pre-contract. The majority of the magnitude of differential in scoring are of “mid-range” which potentially indicates a common view of the notion of trust within the network; but it is noted that the reduction in the mode of scoring results in a “middling to mostly trusting” network rather than “mostly trusting” as pre-contract.

Comparative observations

The movement of key measures from the data between the two time frames could indicate general trend, in the following way;

Movement from Pre to Post Contract	
Mode	-1.15
Coefficient of variation	1.22%
Average score	-0.137
Average difference	0.000
Average magnitude	0.123

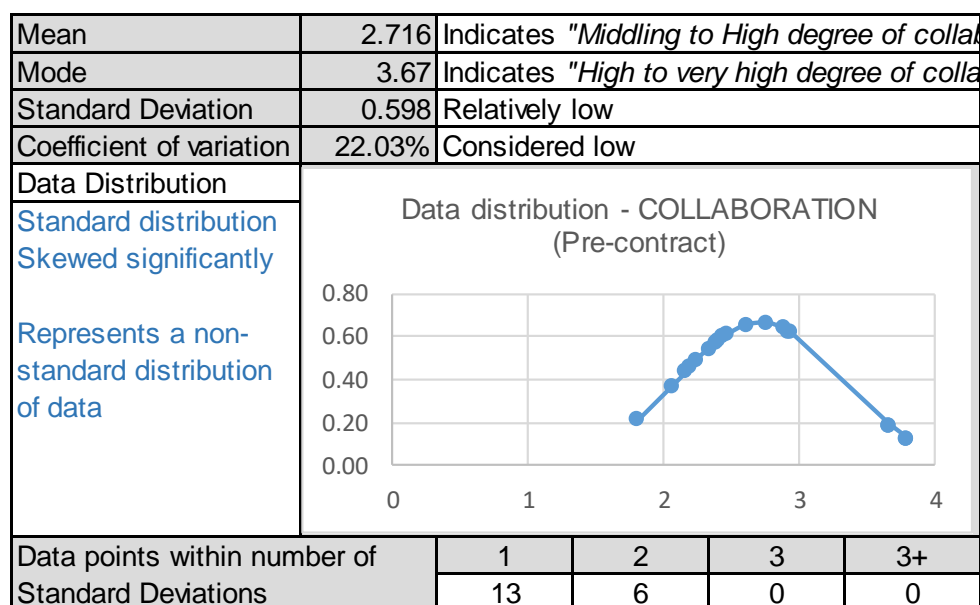
- *Mode decreasing*; lower trust scoring
- *Coefficient of variation*; an increased difference in degree of trust
- *Average score*; generally reduced levels of trust
- *Average difference*; similar reciprocal scoring, similar network view?
- *Average magnitude*; increase in the variation of difference between reciprocal scoring, less reciprocally balanced trust

The degree of trust reduced, with the mode reducing by over one score range, between the two periods, and in addition to this the view of the trust levels and how these are reciprocated broadened between the respondents. In terms of the project, where *consistent trust* should have been the minimum given the procurement approach, there is a potential failure here. It seems that the collaborative approach adopted has not had the impact on the trust relationships that the theory behind this approach assumed would be forthcoming. It appears to have had the opposite impact.

What degree of collaboration is there with each actor?

Three months prior to Contract execution

COLLABORATION (PRE): Individual scores response : *Figure D.1.6.3*



COLLABORATION (PRE): Individual reciprocal scores response : *Table D.1.6.3*

	Average Score	Average difference	Average magnitude	Difference	Magnitude
CEC	1.81	-0.50	1.06	Less collaborative	Significant difference
SPM1	2.92	0.06	0.72	More collaborative	Mid-range difference
PM2	2.44	0.00	0.78	More collaborative	Mid-range difference
LAr	2.07	-0.50	0.94	Less collaborative	Mid-range difference
Arc1	2.47	-0.44	0.67	Less collaborative	Mid-range difference
CSE1	2.20	-0.83	1.06	Less collaborative	Significant difference
BSM	2.39	-0.39	1.06	Less collaborative	Significant difference
BSE	2.33	-1.11	1.33	Less collaborative	Significant difference
CQS	2.89	-0.17	0.61	Less collaborative	Mid-range difference
CQS1	2.40	-0.50	0.83	Less collaborative	Mid-range difference
CoL1	2.61	0.56	1.11	More collaborative	Significant difference
CPM1	3.67	1.06	1.28	More collaborative	Significant difference
CPM2	2.76	0.72	1.06	More collaborative	Significant difference
CCM1	3.67	1.17	1.39	More collaborative	Significant difference
CCM2	2.94	0.83	1.06	More collaborative	Significant difference
CDM	2.25	-1.00	1.22	Less collaborative	Significant difference
CME1	2.17	0.06	1.06	More collaborative	Significant difference
SCM1	3.80	0.50	0.56	More collaborative	Mid-range difference
SCE1	3.80	0.50	0.56	More collaborative	Mid-range difference

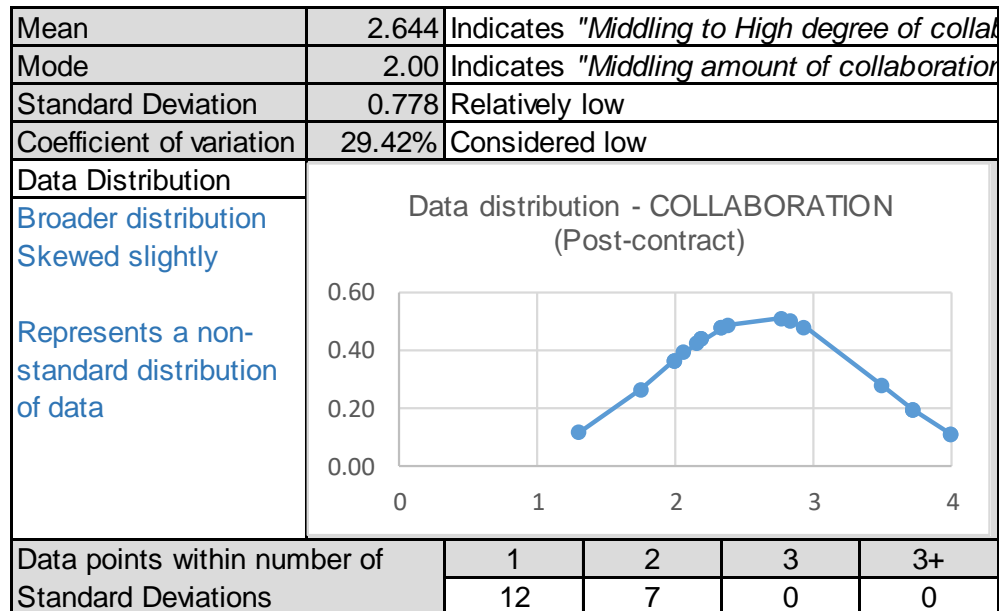
Observations

Even with a small number of lower scoring respondents the network view represents a high degree of collaboration. There is a general split within the network (although there are exceptions) whereby the Contractor side has a higher scoring view than that of the Client side of the collaboration within the network. This potentially reflects a more positive view of the pre-contract collaboration than that taken by the Client side team; this is particularly highlighted by the response from actor CEC who, again, scores this aspect significantly lower than the average. Conversely, actors CPM1 and CCM1 (Contractor leaders) appear to have a higher scoring view of the collaboration than the general consensus, whereas their colleague, CDM (managing design aspects) is the only one of their team who has a lesser view of the collaboration, in a scoring sense.

What degree of collaboration is there with each actor?

Three months following Contract execution

COLLABORATION (POST): Individual scores response : *Figure D.1.6.4*



COLLABORATION (POST): Individual reciprocal scores response : *Table D.1.6.4*

	Average Score	Average difference	Average magnitude	Difference	Magnitude
CEC	1.75	-0.50	0.83	Less collaborative	Mid-range difference
SPM1	2.77	0.28	0.83	More collaborative	Mid-range difference
PM2	2.33	0.17	0.61	More collaborative	Mid-range difference
LAr	1.31	-0.83	0.94	Less collaborative	Mid-range difference
Arc1	2.20	-0.44	1.00	Less collaborative	Mid-range difference
CSE1	2.00	-0.61	1.06	Less collaborative	Significant difference
BSM	2.39	0.33	0.89	More collaborative	Mid-range difference
BSE	2.00	-0.28	1.28	Less collaborative	Significant difference
CQS	2.33	0.11	0.78	More collaborative	Mid-range difference
CQS1	2.06	-0.22	0.44	Less collaborative	Minimal difference
CoL1	3.50	-0.78	0.78	Less collaborative	Mid-range difference
CPM1	3.72	0.94	1.28	More collaborative	Significant difference
CPM2	2.94	0.28	0.83	More collaborative	Mid-range difference
CCM1	3.72	1.33	1.56	More collaborative	Significant difference
CCM2	2.83	0.67	1.00	More collaborative	Mid-range difference
CDM	2.20	-0.89	1.11	Less collaborative	Significant difference
CME1	2.17	0.11	1.00	More collaborative	Mid-range difference
SCM1	4.00	0.17	0.50	More collaborative	Minimal difference
SCE1	4.00	0.17	0.50	More collaborative	Minimal difference

Observations

There is very little difference to the pre-contract period in the responses here, with largely the same or similar responses from individuals. That is aside from the lower scoring responses meaning that the network view is of only middling collaboration; not necessarily what is expected of a team having gone through an early stage collaborative engagement who are actively commencing construction works and all that involves. Again, CPM1 and CCM1 have the highest regard for the collaboration within the network as far as scores displayed, but not necessarily shared by other actors.

Comparative observations

The movement of key measures from the data between the two time frames could indicate general trend, in the following way;

Movement from Pre to Post Contract	
Mode	-1.67
Coefficient of variation	7.39%
Average score	-0.072
Average difference	-0.000
Average magnitude	-0.058

- *Mode decreasing*; significantly lower collaboration scoring
- *Coefficient of variation*; an increased difference in degree of the view of collaboration
- *Average score*; marginally reduced levels of collaboration
- *Average difference*; similar reciprocal scoring, similar network view?
- *Average magnitude*; reduction in the variation of difference between reciprocal scoring, more reciprocally balanced view of collaboration action.

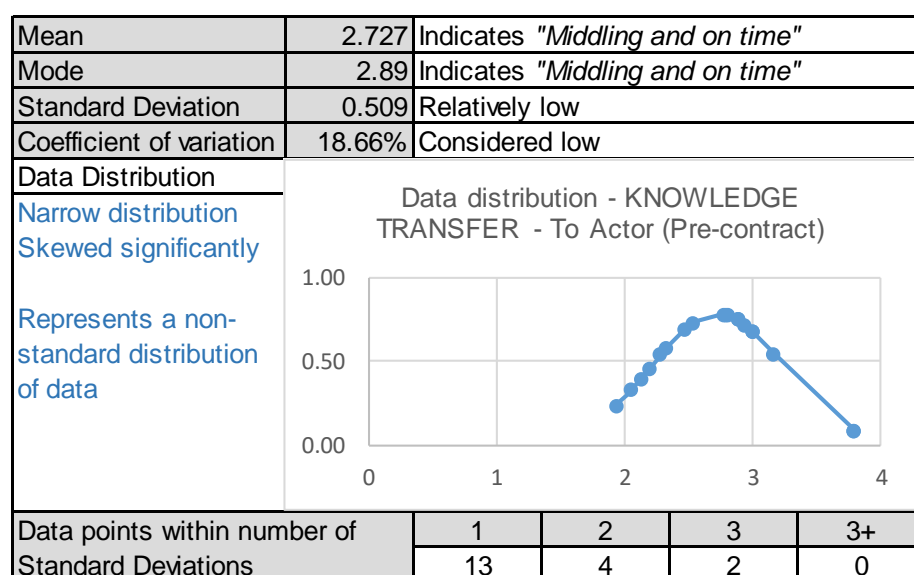
Given the idea of the procurement was to ensure effective collaboration, the scoring of this aspect appears to indicate it has not quite *hit the mark*; and the decrease in the view of collaboration following the contract execution could be considered a failing, when realistically the entire team need to all pull in the right direction at a key time. The comments from interviews are reflected in this scoring.

What degree of Transfer of Knowledge is there with each actor - **To actor?**

Three months prior to Contract execution

KNOWLEDGE TRANSFER TO ACTOR (PRE): Individual scores response :

Figure D.1.6.5



KNOWLEDGE TRANSFER TO ACTOR (PRE): Individual reciprocal scores response : Table D.1.6.5

		Average difference	Average magnitude	Difference	Magnitude
CEC	1.94	-0.72	0.94	Less KT TO Actor	Mid-range difference
SPM1	3.00	-0.06	0.50	Less KT TO Actor	Minimal difference
PM2	2.78	0.17	0.83	More KT TO Actor	Mid-range difference
LAr	2.29	-0.72	0.83	Less KT TO Actor	Mid-range difference
Arc1	2.80	-0.28	0.83	Less KT TO Actor	Mid-range difference
CSE1	2.47	-0.39	0.94	Less KT TO Actor	Mid-range difference
BSM	2.94	0.28	0.61	More KT TO Actor	Mid-range difference
BSE	2.20	-1.06	1.28	Less KT TO Actor	Significant difference
CQS	2.89	0.11	0.56	More KT TO Actor	Mid-range difference
CQS1	2.13	-0.72	1.17	Less KT TO Actor	Significant difference
CoL1	2.89	0.78	1.11	More KT TO Actor	Significant difference
CPM1	3.17	0.72	0.94	More KT TO Actor	Mid-range difference
CPM2	2.53	0.44	1.00	More KT TO Actor	Mid-range difference
CCM1	3.00	0.44	0.78	More KT TO Actor	Mid-range difference
CCM2	2.33	0.17	0.61	More KT TO Actor	Mid-range difference
CDM	2.81	0.06	1.06	More KT TO Actor	Significant difference
CME1	2.06	0.00	1.33	More KT TO Actor	Significant difference
SCM1	3.80	0.39	0.50	More KT TO Actor	Minimal difference
SCE1	3.80	0.39	0.50	More KT TO Actor	Minimal difference

Observations

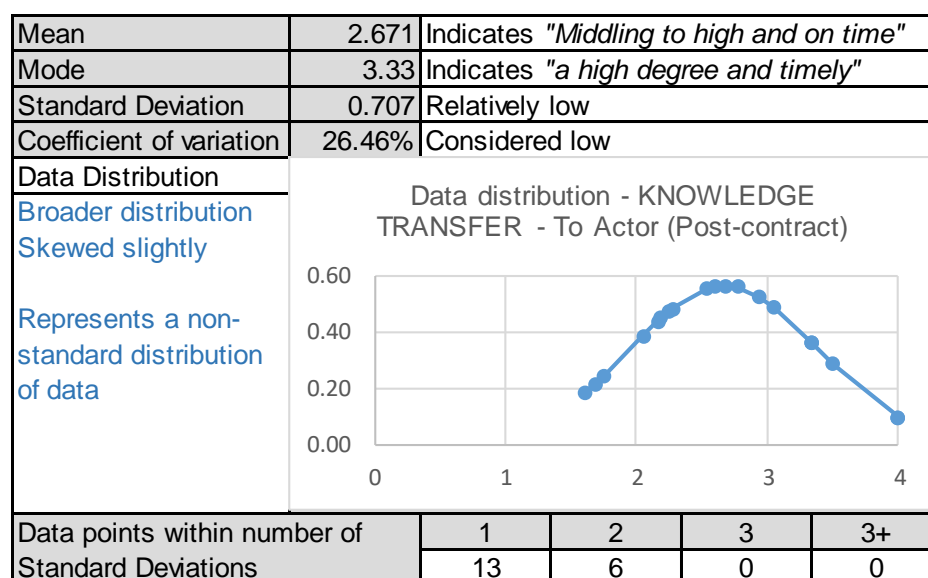
The requirements of a procurement approach such as was undertaken here would lend themselves to a necessity for a high degree of Knowledge Transfer; the 2 stage approach positively involves it. But the scoring from the network intimates that the transfer of knowledge TO other actors was merely “middling” (albeit it is erring *towards* a high degree), but at least it was “on time” (albeit comments from the interviews suggest at times this was not the case). The MEP subcontractor’s (SCM1 and SCE1) scores are significantly higher than the rest of the network, creating a *leading tail* in the data distribution. However, their involvement pre-contract involved a high degree of knowledge distribution, through collaborative workshops and the like, and the view from those in the network who scored this aspect tends to not disagree with their high scoring view. There are other actors (BSE and CME1), both involved in the MEP collaboration who’s view on scoring significantly differed from others in the network, which lends itself to them having a separate, personal, view of how effective the knowledge transfer may have been.

What degree of Transfer of Knowledge is there with each actor - To actor?

Three months following Contract execution

KNOWLEDGE TRANSFER TO ACTOR (POST): Individual scores response :

Figure D.1.6.6



KNOWLEDGE TRANSFER TO ACTOR (POST): Individual reciprocal scores response : *Table D.1.6.6*

		Average difference	Average magnitude	Difference	Magnitude
CEC	2.19	-0.44	0.78	Less KT TO Actor	Mid-range difference
SPM1	2.77	0.17	0.61	More KT TO Actor	Mid-range difference
PM2	3.06	0.61	0.83	More KT TO Actor	Mid-range difference
LAr	1.69	-0.83	1.06	Less KT TO Actor	Significant difference
Arc1	2.53	-0.11	1.00	Less KT TO Actor	Mid-range difference
CSE1	2.25	-0.17	0.94	Less KT TO Actor	Mid-range difference
BSM	2.94	0.89	1.00	More KT TO Actor	Mid-range difference
BSE	2.17	-0.06	1.06	Less KT TO Actor	Significant difference
CQS	1.61	-0.39	0.50	Less KT TO Actor	Minimal difference
CQS1	1.75	-0.44	1.00	Less KT TO Actor	Mid-range difference
CoL1	3.50	-0.83	1.06	Less KT TO Actor	Significant difference
CPM1	3.33	0.72	0.94	More KT TO Actor	Mid-range difference
CPM2	2.69	-0.11	1.00	Less KT TO Actor	Mid-range difference
CCM1	3.33	0.94	1.17	More KT TO Actor	Significant difference
CCM2	2.28	0.06	0.83	More KT TO Actor	Mid-range difference
CDM	2.60	-0.22	1.00	Less KT TO Actor	Mid-range difference
CME1	2.06	0.00	1.56	More KT TO Actor	Significant difference
SCM1	4.00	0.11	0.61	More KT TO Actor	Mid-range difference
SCE1	4.00	0.11	0.61	More KT TO Actor	Mid-range difference

Observations

The view of the network appears to have improved on how the transfer of knowledge was enacted following contract execution (when taking the mode score; the average actually *decreases* slightly). This seems to be almost counter-intuitive given the responses on trust and collaboration but may reflect the network's drive to get the project moving and that there was a construction contract in place now; so key transfer of knowledge (information) was essential (and contractual). The average magnitudes also indicate a heightened consensus between the actors on how each of them are enacting knowledge transfer to others (even though the co-efficient of variation says otherwise, likely due to further outlier scores on the leading tail, including CoL1 and his network position); aside from CME1 who's view seems to have worsened in comparison to others.

Comparative observations

The movement of key measures from the data between the two time frames could

Movement from Pre to Post Contract	
Mode	0.44
Coefficient of variation	7.81%
Average score	-0.057
Average difference	0.000
Average magnitude	0.064

indicate general trend, in the following way;

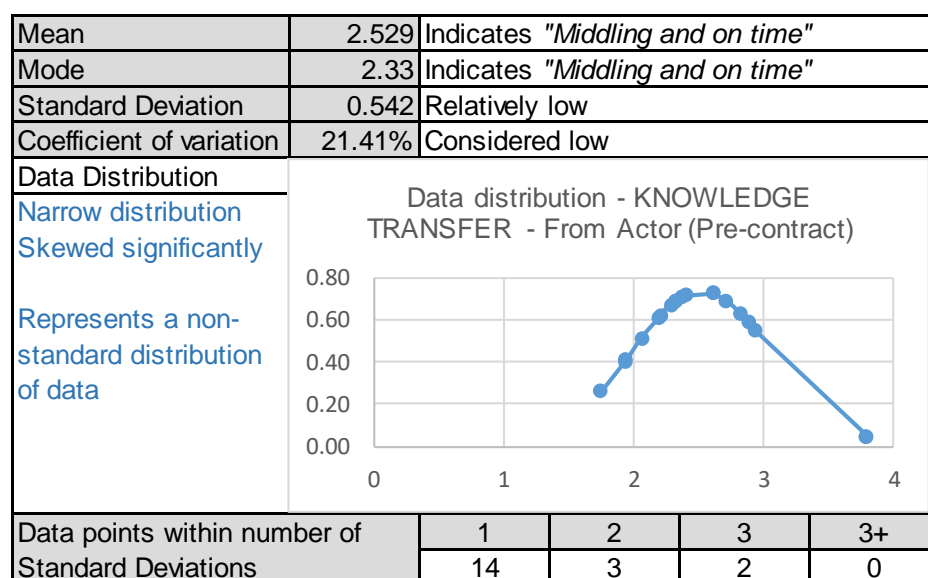
- *Mode increasing*; higher Knowledge Transfer scoring, more positive
- *Coefficient of variation*; an increased difference in degree of Knowledge Transfer (refer note above)
- *Average score*; generally reduced levels of Knowledge Transfer in this
- *Average difference*; no change in reciprocal scoring
- *Average magnitude*; increase in the variation of difference between reciprocal scoring, slightly less reciprocally balanced view of Knowledge Transfer TO actors

A mixed message from the data, likely due to a number of outliers, but the most telling indication is in how the most scored score (mode) increased despite the other measures (so far) decreasing. Knowledge transfer having to happen despite relationships as contract is enacted.

What degree of Transfer of Knowledge is there with each actor - **From actor?**

Three months prior to Contract execution

KNOWLEDGE TRANSFER FROM ACTOR (PRE): Individual scores response
: Figure D.1.6.7



KNOWLEDGE TRANSFER FROM ACTOR (PRE): Individual reciprocal scores response : Table D.1.6.7

		Average difference	Average magnitude	Difference	Magnitude
CEC	1.75	-0.50	0.72	Less KT FROM Actor	Mid-range difference
SPM1	2.62	-0.06	0.61	Less KT FROM Actor	Mid-range difference
PM2	2.61	0.56	0.89	More KT FROM Actor	Mid-range difference
LAr	2.21	-0.44	0.56	Less KT FROM Actor	Mid-range difference
Arc1	2.20	-0.39	0.83	Less KT FROM Actor	Mid-range difference
CSE1	1.93	-0.67	1.00	Less KT FROM Actor	Mid-range difference
BSM	2.89	0.67	1.11	More KT FROM Actor	Significant difference
BSE	2.07	-0.72	1.06	Less KT FROM Actor	Significant difference
CQS	2.83	0.00	0.44	More KT FROM Actor	Minimal difference
CQS1	2.40	-0.44	0.89	Less KT FROM Actor	Mid-range difference
CoL1	2.33	0.39	0.94	More KT FROM Actor	Mid-range difference
CPM1	2.94	0.39	0.72	More KT FROM Actor	Mid-range difference
CPM2	2.29	0.28	0.72	More KT FROM Actor	Mid-range difference
CCM1	2.72	0.22	0.67	More KT FROM Actor	Mid-range difference
CCM2	2.33	0.28	0.61	More KT FROM Actor	Mid-range difference
CDM	2.38	-0.39	0.61	Less KT FROM Actor	Mid-range difference
CME1	1.94	-0.06	0.94	Less KT FROM Actor	Mid-range difference
SCM1	3.80	0.44	0.50	More KT FROM Actor	Minimal difference
SCE1	3.80	0.44	0.50	More KT FROM Actor	Minimal difference

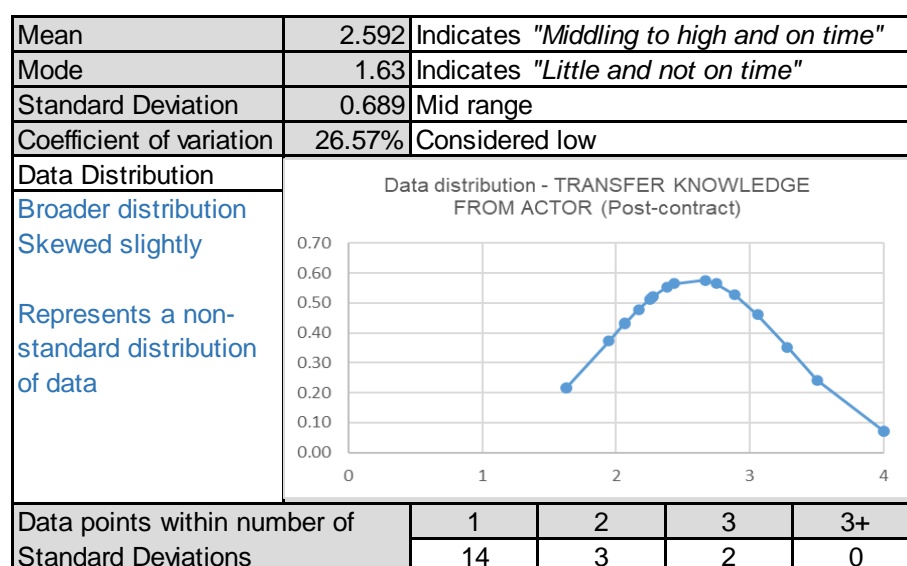
Observations

The network suggest that Knowledge transfer FROM other actors is very much *middling* and is less when compared to that transferred TO other actors in the pre-contract period; this indicates that, in general, the actors perceive that they are contributing more to the transfer of knowledge than those who should be transferring knowledge to them. In relation to building services, the actors involved in the pre-contract engagement provide a range of responses. Whilst, again, the MEP subcontractors (SCM1 and SCE1) score highly, indicating that they perceived a high degree of information, the Designers (BSM and BSE) and the Building Services Manager (CME1) score significantly lower, with high degrees of magnitude of divergent scoring. This represents a significant difference in views from those involved and could indicate an issue in itself on the consistency of the respondents. However, taking the scores on face value would intimate that the subcontractors believe that information was suitable and available, whilst those working with them believe that not to be the case. We should remind ourselves here on comments made in the interviews where some thought the MEP interaction to be a positive, whilst others had reservations on its benefits; these to sources of data appear to support one another.

What degree of Transfer of Knowledge is there with each actor - From actor?

Three months following Contract execution

KNOWLEDGE TRANSFER FROM ACTOR (POST): Individual scores response : *Figure D.1.6.8*



KNOWLEDGE TRANSFER FROM ACTOR (POST): Individual reciprocal scores response : *Table D.1.6.8*

		Average difference	Average magnitude	Difference	Magnitude
CEC	2.25	-0.06	0.61	Less KT FROM Actor	Mid-range difference
SPM1	2.38	-0.06	0.61	Less KT FROM Actor	Mid-range difference
PM2	2.67	0.67	0.89	More KT FROM Actor	Mid-range difference
LAr	1.63	-0.61	0.83	Less KT FROM Actor	Mid-range difference
Arc1	2.07	-0.28	0.83	Less KT FROM Actor	Mid-range difference
CSE1	1.63	-0.72	0.94	Less KT FROM Actor	Mid-range difference
BSM	2.89	1.28	1.28	More KT FROM Actor	Significant difference
BSE	2.17	0.22	0.89	More KT FROM Actor	Mid-range difference
CQS	2.75	0.39	0.83	More KT FROM Actor	Mid-range difference
CQS1	2.06	-0.17	0.83	Less KT FROM Actor	Mid-range difference
CoL1	3.50	-0.89	1.11	Less KT FROM Actor	Significant difference
CPM1	3.28	0.56	0.89	More KT FROM Actor	Mid-range difference
CPM2	2.44	-0.44	0.56	Less KT FROM Actor	Mid-range difference
CCM1	3.06	0.61	0.83	More KT FROM Actor	Mid-range difference
CCM2	2.28	0.11	0.78	More KT FROM Actor	Mid-range difference
CDM	2.27	-0.72	0.83	Less KT FROM Actor	Mid-range difference
CME1	1.94	-0.11	1.11	Less KT FROM Actor	Significant difference
SCM1	4.00	0.11	0.50	More KT FROM Actor	Minimal difference
SCE1	4.00	0.11	0.50	More KT FROM Actor	Minimal difference

Observations

Higher scoring in the period after Contract execution, again reflecting comments in the TO actor response, in that knowledge transfer appears to have been enacted to a more effective level when it was necessary and contractually obliged. One key area of note is in the significant difference in scoring in relation to BSM and other network members and, if we recall from the interviews on comments on information and timing of same in regards some aspects of the building services; in this instance mechanical services.

The Mode output is somewhat off-putting (if not actually incorrect). There are the same amount of 4's scored as there are 1.63 scores. The data output in this case comes with a caveat, only noted when investigating the data further, and for this reason the Mean is more representative of the shift in scoring.

Comparative observations

The movement of key measures from the data between the two time frames could indicate general trend, in the following way;

Movement from Pre to Post Contract	
Mode	-0.71
Coefficient of variation	5.15%
Average score	0.062
Average difference	0.000
Average magnitude	0.070

- *Mode increasing*; lower Knowledge Transfer scoring (**discounted as note above, data issue**)
- *Coefficient of variation*; an increased difference in degree of Knowledge Transfer
- *Average score*; generally, marginally, increased levels of Knowledge Transfer
- *Average difference*; virtually no change in reciprocal scoring
- *Average magnitude*; increase in the variation of difference between reciprocal scoring, less reciprocally balanced view of Knowledge Transfer

The data perhaps does not quite reflect the observed changes in all aspects. The general movement is that there was slightly increased scoring of the Knowledge Transfer FROM other actors and is likely due to the same reasons noted in that section.

When comparing the TO ACTOR to FROM ACTOR responses the following is observed.

	TO Actor			FROM Actor		
	pre	post	m'ment	pre	post	m'ment
Mean	2.73	2.67	-0.06	2.53	2.59	0.06
Mode	2.89	3.33	0.44	2.33	1.63	-0.71

Table D.1.6.8.1 Knowledge transfer comparison

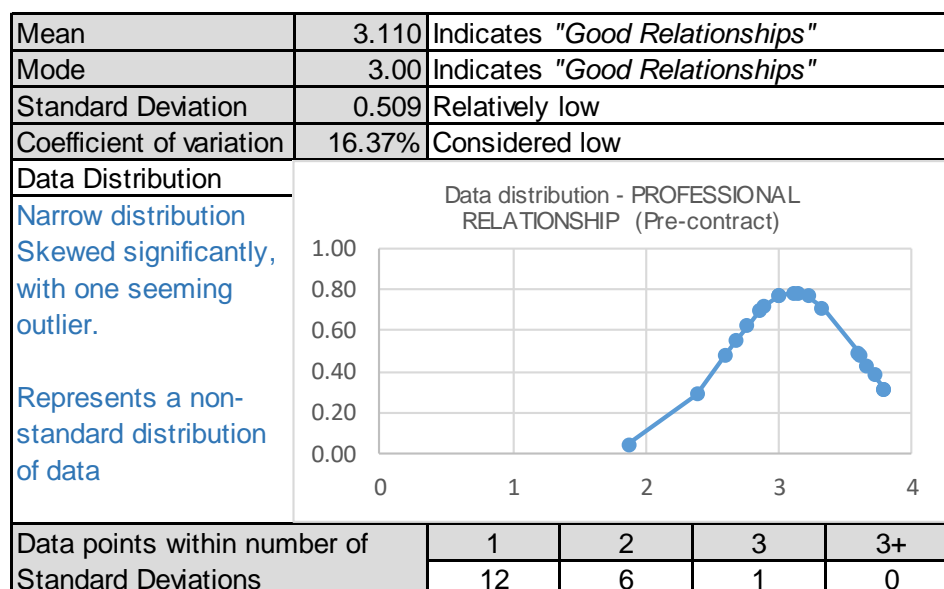
From this it appears that in regards knowledge transfer TO other network actors, there is an aberration in the Modal measure in how it is inferring an improvement in this rather than what the mean indicates. From this, it may be inferred that there are differing views within the network on the change in effective knowledge transfer, although the further indications within the data set to show that a number of the actors scoring was more positive between the two periods. A similar comment is made in regard FROM other network actors as, despite the data above there are comparisons within the data set. That the data represents a confused situation may be representative of the personal responses, driven by the context of the events both leading up to contract execution (where relationships were fraught) and the pressures of enacting the site activities once the contract was executed.

What is the manner of relationship between yourself and each actor?

Three months prior to Contract execution

PROFESSIONAL RELATIONSHIP (PRE): Individual scores response : *Figure*

D.1.6.9



PROFESSIONAL RELATIONSHIP (PRE): Individual reciprocal scores response : *Table D.1.6.9*

		Average difference	Average magnitude	Difference	Magnitude
CEC	1.88	-1.11	1.11	Less positive	Significant difference
SPM1	3.15	-0.28	0.83	Less positive	Mid-range difference
PM2	2.39	-0.39	1.06	Less positive	Significant difference
LAr	3.00	-0.33	0.56	Less positive	Mid-range difference
Arc1	2.60	-0.56	0.89	Less positive	Mid-range difference
CSE1	2.87	-0.56	0.67	Less positive	Mid-range difference
BSM	2.89	-0.22	0.67	Less positive	Mid-range difference
BSE	3.60	-0.17	1.28	Less positive	Significant difference
CQS	3.22	-0.39	0.61	Less positive	Mid-range difference
CQS1	3.00	-0.56	0.89	Less positive	Mid-range difference
CoL1	3.11	0.61	0.83	More positive	Mid-range difference
CPM1	3.72	0.67	0.67	More positive	Mid-range difference
CPM2	2.76	0.44	0.78	More positive	Mid-range difference
CCM1	3.67	0.67	0.78	More positive	Mid-range difference
CCM2	3.33	0.83	1.06	More positive	Significant difference
CDM	2.69	-0.56	1.11	Less positive	Significant difference
CME1	3.61	1.33	1.33	More positive	Significant difference
SCM1	3.80	0.28	0.28	More positive	Minimal difference
SCE1	3.80	0.28	0.28	More positive	Minimal difference

Observations

With a mean suggesting that the relationships are generally good, this refutes (to a degree) some of the comments made in the interviews. However, it is noted that just because one actor may not necessarily trust another, the “professional” relationship may still be relatively effective. actors of note in the scoring are CEC, who scored comparatively lower against the rest of the network. This intimates that they felt that their professional relations were merely *poor to fair*. Given that 1.88 is their average score, one must note that a significant proportion would have been scored as *poor* or *extremely poor*.

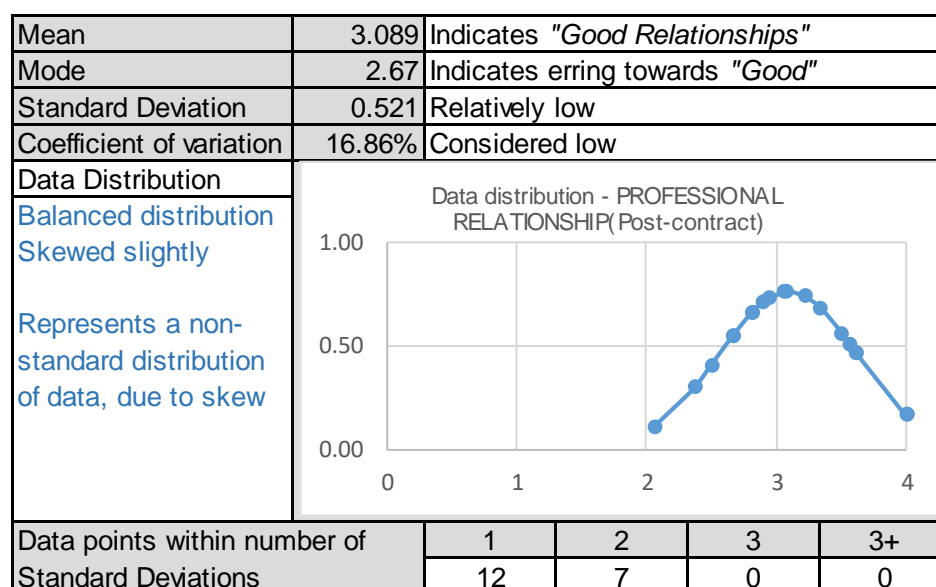
Others of note are BSE, who viewed their relationship with others consistently higher, and CME1, who had a variety of differences in scoring. Both these actors interacted, in regards Building Services, with SCM1 and SCE1 who considered that their relationships in the network were *good to excellent*, with minimal difference in scoring from other actors. This supports other elements within the case study whereby the interaction of those involved in early engagement in regards the Building Services was viewed positively.

What is the manner of relationship between yourself and each actor?

Three months following Contract execution

PROFESSIONAL RELATIONSHIP (POST): Individual scores response :

Figure D.1.6.10



PROFESSIONAL RELATIONSHIP (POST): Individual reciprocal scores response : *Table D.1.6.10*

		Average difference	Average magnitude	Difference	Magnitude
CEC	2.06	-0.83	0.94	Less positive	Mid-range difference
SPM1	3.08	-0.11	1.00	Less positive	Mid-range difference
PM2	2.50	0.00	0.78	More positive	Mid-range difference
LAr	2.38	-0.39	0.72	Less positive	Mid-range difference
Arc1	2.67	-0.28	0.83	Less positive	Mid-range difference
CSE1	2.81	-0.17	0.50	Less positive	Minimal difference
BSM	2.89	0.56	0.89	More positive	Mid-range difference
BSE	3.06	0.44	1.00	More positive	Mid-range difference
CQS	3.22	0.33	0.89	More positive	Mid-range difference
CQS1	2.94	-0.33	0.78	Less positive	Mid-range difference
CoL1	3.50	-1.39	1.39	Less positive	Significant difference
CPM1	3.61	0.50	0.72	More positive	Mid-range difference
CPM2	2.81	-0.22	0.56	Less positive	Mid-range difference
CCM1	3.56	0.72	0.94	More positive	Mid-range difference
CCM2	3.33	0.72	0.94	More positive	Mid-range difference
CDM	2.67	-0.72	1.17	Less positive	Significant difference
CME1	3.61	1.28	1.28	More positive	Significant difference
SCM1	4.00	-0.06	0.61	Less positive	Mid-range difference
SCE1	4.00	-0.06	0.61	Less positive	Mid-range difference

Observations

Still considered as “Good” relationships based on the Mean response, despite the Mode score indicating a somewhat lesser view. CEC considered that relationships improved in general terms following contract execution, which indicates that their view of the pre-contract period was less than positive. Those involved in the Building Services aspects all score highly reflecting the work undertaken in this area and the relationships required. CoL1 potentially an outlier given their view of position in the network compared to others’ view.

Comparative observations

The movement of key measures from the data between the two time frames could indicate general trend, in the following way;

Movement from Pre to Post Contract	
Mode	-0.33
Coefficient of variation	-0.49%
Average score	-0.021
Average difference	0.000
Average magnitude	0.047

- *Mode decreasing*; lower scoring of the wider network

- *Coefficient of variation*; a slightly decreased difference in degree of view of relationship
- *Average score*; minimal reduction of scoring
- *Average difference*; no change in reciprocal scoring
- *Average magnitude*; increase in the variation of difference between reciprocal scoring, less reciprocally balanced view of the relationships

As a network there was very little view of the quality of the professional relationships between the two periods, but overall it went down slightly. The pre-construction period and the activities involved meant that some actors HAD to interact more closely, whereas once the contract was executed this may not have been the case. Whilst still professionally linked, it could be that there was a conscious or sub-conscious slight degradation of some of the network links. This is reflected in the RII score earlier in the case study.

D.1.7 Case Study Summary

This project potentially suffered from the fact it was the first one of the three being undertaken under this procurement approach and, due to this, the issues were encountered here first. This may mean that some of the network have a less positive view of this project and the network as they had to resolve issues in ways that were less than optimal. This also had an impact on the levels of trust between some actors within the network. This indicates a potential issue with the network/project immediately and potentially impacts others within the network and their trust view. The nature of the pre-contract engagement and the trust levels issues had an impact on the project immediately after contract execution and, it is noted, throughout the project.

Likewise, the action of collaboration appears to have been relatively low when it is considered that the entire procurement approach was predicated on acting collaboratively. The view of how this was enacted on this project is somewhat negative, as a network, and was affected by some actors NOT acting collaboratively whilst others did so actively. It was commented that this

approach *should* have worked but was impacted by individuals not buying-in to the process. This is a similar situation with Knowledge Transfer; the point of the approach was to maximise this aspect, to get real professional insights applied to the project. This did not happen in general terms, with exceptions such as the Contractor reorganising the programme dates to meet requirements and the Building Services early engagement (albeit there were still some issues noted by some in this aspect).

In regards the Client clearly stating objectives as the starting point of the project, this has been commented on as being poor. There appears to have been confusion within the network as to what the key value objectives were for the Client, with very little consensus between the network actors. That this “fundamental” or “essential” requirement was not enacted adequately could be the root cause of a number of the other issues noted within the network. This was commented on within some responses from the interviews.

In general terms; what was proposed to deliver the benefits of collaboration, earlier engagement, professional constructors’ advice, quality outcomes and enhanced delivery turned out to under-deliver across the procurement exercise. This meant that the network was then under pressure and overall delivery to a number of key criteria was poor. What the engagement process did benefit from was the ability to meet the expected programme for site start and to allow the procurement of Building Services despite the design progress being slightly behind; both these aspects were due to the procurement approach.

In terms of summarising the response to the over-arching research questions, table D.1.6.11 provides this.

Research Question topic	Case Study position
Levels of Trust	Defined as "Mostly Trusting", reducing post contract
Degree of Collaboration	A "middling to high degree" of collaboration, reducing post contract
Extents of Knowledge Transfer	A "middling" degree initially, with Mean and Mode scores reducing overall post contract. Notably Mode score was <i>"little and not on time"</i> post contract for transfer FROM actors.
Professional Relationship of the Network	Initially "Good", with slight reduction in scoring post contract
Client Objectives defined	Noted as being an "essential" requirement. Poor definition of objectives with some commenting on this not being provided with any clarity. Confusion apparent from the network and this caused issues within the activities.
Building Services Procurement	Those involved in the early engagement provide positive comments on this aspect and note that without this being undertaken, delivery to development programme would have been impossible. Trust, Collaboration, Knowledge Transfer and professional relationships generally score higher within the network from those involved in this aspect.

Table D.1.6.11 : Case Study position summary

D.2 Case Study 2 – Victoria Primary School (VPS)



D.2.1 Case study outline

Victoria Primary School, Edinburgh (VPS) is situated in the North of Edinburgh, near to the shores of the Firth of Forth. It was to replace the existing Victorian school building nearby, including expanded capacity. The site was provided by *Forth Ports* as part of the area's regeneration and was largely *made ground* as the area had previously been for heavy industrial / port usage following reclamation activities early in the 20th century.

VPS was to be a 2-stream Primary school (7 years, 462 pupils) with a 60-place nursery included, along with extensive playground and landscaped areas. A new 7-a-side synthetic pitch for school and community use was to be provided but, due to land ownership issues would be carried out separately.

The CEC applicable Frameworks to this research: *Refer to Case Study 1*

Project Approach: *Refer to Case Study 1*

The Project development followed the same process as BPS. Refer to Table D.2.1 for timeline and values and refer to *Case Study 1* for narrative.

Stage	Date	Value	Building Services %	Comments
Stage 2	06/01/18	£11,931,000	27%	Outline design which had significant architectural requirements
Stage 3	06/02/19	£13,362,000	26%	Developed design with Client additions
Stage 4	31/07/19	£13,516,000	26%	VE undertaken between Stages 3 and 4, including Contractor early input; but also additional requirements (based on BPS)
Contract	24/02/20	£13,760,000	26%	Following full Work Package Market response and Enabling Works
Completion / FA	21/12/21	£16,798,000	24%	Significant change, delay and other factors increase overall cost. MEP % reduction due to allocation of these change costs.

Table D.2.1 - Key milestones and values

D.2.2 Notable events/issues in delivery

A number of events or issues that are relevant to the case study are included here.

Refer to Case Study 1.

In addition

- i. The issues encountered on Case Study 1 regarding Building Warrant were not as significant on this project but were still an issue. They were minimised by the agreement to undertake enabling works, consisting of early earthworks and the like. Given the nature of the Brownfield site this proved advantageous and the 3-4 months of enabling works *unearthed* issues within the ground that were not anticipated; these were then able to be resolved prior to full contract works.
- ii. VPS benefitted from some *lessons learned* from BPS (case study 1) given that it started construction afterwards. There still remained issues

as outlined elsewhere in the communication around design aspects which put significant pressure on delivery and the project team.

D.2.3 Section 1 – Interview Questions

1. Trust and project delivery

Q1.1 - In general, what is your view on trust and the role it plays in project delivery?

Refer to Case Study 1.

In addition; the different actors agreed that it was “*paramount*”, “*critical*” and “*extremely important*”. One actor was more pragmatic about the requirements of trust; “*Trust isn’t probably as open as it should be in the industry. It’s very much people based, as an industry and as projects go*”. Another, drawing on experience, commented “*You have to have trust between all parties to understand what outcomes can look like. Whether that’s achievable is another thing...*”

One noted how critical trust is to delivery; “*To work as a team, if you don’t trust as part of that team, then delivery will be very hard. Having no trust is a disaster in regards construction project teams.*”

Q1.2 - Specifically for this project, how do you think the level of trust between the actors had an impact on Delivery?

Refer to Case Study 1.

In addition;

Mirroring the comments made elsewhere the different actors had similar views, explaining that there were different levels of trust within the network. Most significantly the difference in trust levels between Client team and contractor team; comments such as “*There is a disconnect in trust with the construction team which is making things quite difficult post contract*” and “*I still think there are issues with some of the design team. They sometimes can*

be obstructive and haven't come to the party on this project". These are two comments from either side of the dividing line.

There were comments on where there is a positive view of trust within the network; *"My wariness of the architect however doesn't extend my wariness to other members of the Client team. I have high levels of trust of other team members"* and *"the levels of trust within the commercial workstream assisted the package development. I think it helped the process and the information provided was trustworthy"*.

On the question of previous relationships having an impact on trust in this network; *"It has felt good and felt right from our point of view. We work well with the MEP designer, we know them well"*, counterpointed by *"But the same architect practice have worked with us before and have been excellent – they aren't the same on this project and I'm wary of them here. And I've worked with them a lot over the years. But I don't get the same feeling from this Design Team that I have on previous projects"*.

And in comparison to the other projects being studied *"I think VPS is a better situation. There is limited communication on the others, which is disappointing, but also indicates potential problems with those involved and their understanding of the communication requirements"*.

Taking these comments in isolation, it is clear that there are differing views of the trust within the network, and these are of a personal nature.

Q1.3 - Specifically for this project, what level of trust do you think was active between the actors?

Refer to Case Study 1.

In addition; some of the actors noted a degree of potential *"discord"* between members of the design team; *"There have been more notable squabbles between the architect and the MEP designers"* and that this may have been stimulated by a lack of trust elsewhere *"My feeling is that there is not a huge amount of trust from the PM team and this probably comes from frustration with performance to date"*, but it was also observed *"There is still a good*

relationship and that's built on experience of each other. Project problems have put tension on the relationship, but there is still a good level of trust there".

Others commented once more on the positive trust relationships within the network but mused on how the general landscape potentially limits total integration, *"this might have been somewhat affected by the general construction industry view of trust between Client and contractor. This stigma will never be completely eroded by whatever level of collaboration you have".*

Specifically in regards the Building Services engagement and how the relationship with the Contractor was noted as being more trusting, *"the MEP designer has the Client's interests at the heart of their provision. But the nature of the design and procurement process meant that there had to be a high degree of trust for us all, even if the MEP designer still had to consider their position in order to protect the Client's position. But it didn't degrade what we did."*

2. Trust and knowledge transfer

Q2.1 - In general, what is your view on the role of trust in the transfer of Project knowledge?

Refer to Case Study 1.

In addition; the additional actors agreed that trust is of paramount importance in this aspect. One aspect that a number of them agreed on was to do with experience. *"Experience is a big factor in how trust works. Successful jobs are generally harmonious jobs. Getting experience through to the entire team requires everyone to buy in and work together to transfer the experience and knowledge. Problem is getting everyone to the party"* and *"Experience and expert knowledge is essential in getting projects done. Transferring this is key for making it easier for everyone"*.

One further observation was regarding attitude towards the transfer of knowledge and how that might not align with overarching corporate policies,

“You have to trust in order to work on that knowledge transfer, and earlier or previous involvement with others assists that. But all parties need to come with the right approach and be willing to share unequivocally; and that doesn’t always align with organisations requirements”. This view of the right approach was echoed by another and expanded on what this means to producing good outcomes “You need all main players on board early and doing the collaboration properly and effectively. Doing things properly gets you a level of detail that means you can deliver better”.

Q2.2 - Specifically for this project, how do you think the level of trust between the actors had an impact on the transfer of key knowledge?

Refer to Case Study 1.

In addition; the divided opinion noted elsewhere was echoed by other actors; with both sides of the Client/contractor divide offering suggestions on the others performance, *“There is disappointment in the early stages with the Contractor. Wanted more from them at the earliest stages, more input from their experience etc. I think we should have expected more from them”* and *“There’s been dogmatism in the design with a degree of intransigence within the Design team, and efficiencies which could have been brought in have been ruled out without due care”*. These responses in themselves display a lower level of trust arguably. To counter this, others have more positive comments on their experience of how trust affected knowledge transfer; *“On the commercial side, the trust levels helped the procurement programme. If we had had less trust between ourselves and the cascade of trust to the supply chain, we wouldn’t have been able to undertake this as expediently”,* however they do point out that *“When we attempted to transfer the supply chain knowledge to the team, some of it was challenged or negated”*.

In regards Building Services specifically, again there is a degree of positivity; *“the transfer of knowledge has been successful and that the trust in doing this is patently obvious. [It] is probably borne out of initial trust that predates this project, a recognition that we bring and transfer our knowledge effectively”*.

So whilst some parts of the network provide how the levels of trust had a positive impact on some knowledge based activities, there are more critical comments on how trust, or potentially the lack of trust, had a negative impact on the transfer of knowledge.

Q2.3 - Specifically for this project, how effective was the transfer of key knowledge?

Refer to Case Study 1.

In addition; the additional actors acknowledged that there had been degrees of effectiveness despite comments made in response to earlier questions. What they do specifically note is the benefit of the involvement in the earlier project(s) (Case studies 0 (where relevant) and 1); *“Victoria has absolutely benefitted from the errors made at Broomhills”* and *“The knowledge within the Client side team was shared effectively, but probably due to our being involved on other projects before these, including St Johns”*. There are still reservations on the overall effectiveness of the transfer of knowledge generally however, *“There were some benefits from what we did but I don’t think it has been significantly effective overall”* and *“It’s been reasonable but could have been better. It’s been constrained by pressures of the project and the effect on the characters involved”*. These responses are not dissimilar to the rest of the network.

Again, there was positivity around the aspects of the commercial elements of the project and the Building Services engagement; *“It has been effective. It’s brought a big benefit to these projects for Client, contractor and for sub-contractor”*.

3. Differing inter-actor perception of trust

Q3.1 - In general, what is your view on the perception of differing levels of trust between construction project actors, and how this affects inter-project relationships?

Refer to Case Study 1.

In addition; a comment made, plainly from experience, is *“There is still a disconnect between the main parties in construction, but this has improved over time. Teams do tend to work better these days but there is still room for improvement”*. The different actors agreed with comments made elsewhere.

Q3.2 - Specifically for this project, what is your view on how different perceptions of the levels of trust between actors affected relationships?

Refer to Case Study 1.

In addition; comments were made on the, at times, fractious nature of the relationships in the network; *“There have been noticeable squabbles. Trust has wavered in certain instances, and that’s not just between contractor and Client team; there have been some instances between DT members too.”*

There was also an acknowledgement on the benefits of the earlier work on BPS (Case Study 1); *“Victoria is better than Broomhills, that’s for sure. But that’s because Broomhills was first, and we have gone through the Pain Barrier. The lessons learnt at Broomhills have probably enabled better relationships to form on this project, especially within the design elements. There is less acrimony.”*

However, there was an observation on the levels of perception of trust and the impact this had on how messages were received, especially in the commercial context; *“It was very apparent that the contractor did not feel trusted by the Client and some members of the Client team. In the project budget movement, the contractor felt like the Client thought that they were “at it!”, which plainly has an effect on the relationship.”*

Finally it was noted that, on site there were some instances where trust was not apparent, and this got in the way; *“But that’s PEOPLE – who had never*

worked together before. That's construction for you though." Which reflects the imbalance between those who already had trust relationships (good or bad) and those that did not.

Q3.3 - Specifically for this project, to what level do you think any disparity in trust levels affected the outcomes of the Project Delivery?

Refer to Case Study 1.

In addition; One of the respondents answered this in a way which reflects other comments, and how similar views on the levels of trust between actors are not necessarily an issue *"There are some relationships where the trust levels (i.e. the lower level of trust) are absolutely clear. Which in itself is transparent; and I think most of us have acted quite transparently. Issues get resolved quicker like that."* With the issue being where there is disparity; *"Maybe some of the team don't believe the same; i.e. the Client might not think the contractor is being 100% transparent. And that difference in opinion may make things harder to resolve or deliver."*

Another noted that the difference in trust levels between, say, the Designers and the Contractor meant that some design decisions might not have been optimal; *"The trust levels had an impact on key areas of design elements. Some of the contractor's suggestions on changes to the design were patently met with distrust and were not accepted"*. The impact of this might not be fully realised until construction issues arises, but it also drives a degree of ill will between some actors within the network and wone which might have a negative impact on delivery.

4. Client definition of objectives

Q4.1 - In general, what is your view on how the Client defining their key value objectives affects performance delivery?

Refer to Case Study 1.

In addition; The further respondents agreed entirely with the rest of the network in the critical nature of Clients' being *strong in setting their robust requirements and then sticking to them.*

One respondent reflected on the nature of Client's requirements and how deliverers need to be mindful of these; *"Most Clients objectives are generally the same. Cheap as they can, on time, zero defects. Say what you're going to do and do what you say. Within the Public sector, VFM is especially important. The nature of how a Client describes these objectives is important to being able to deliver."*

And another noted the balancing of cost and time in meeting quality aspirations; *"We see an awful lot around the aspects of Quality and delivery and Clients being assured of this. Costs and Time then dilute this... But it needs to be clear from the outset to be able to align with these objectives. Having a clearly defined brief will have a massive impact on delivering successfully."*

Q4.2 - For this project, what were the Client's value objectives and how were they defined?

Refer to Case Study 1.

In addition; the additional respondents were clearly aligned with the majority of the other network members in that they believed these hadn't been clearly defined, and that this meant there was inherent confusion. Even from the outset the team *"were first told that the Client wanted "3 more St Johns". Which was almost immediately superseded by technical requirements saying they didn't want that. And that change in approach hasn't been managed very well."* The main points made were regards there being no written brief. Even this project's Contractor PM was seemingly unaware of the *"Contractor's Client Charter"* mentioned in Case Study 1. The lack of written brief meant that *"the objectives have been perception driven. Some thought it was QUALITY driven looking at the spec, but this then conflicts with the cost aspirations. That rigid conflict was a problem and hasn't really been resolved."*

Q4.3 - Specifically for this project, what is your view on how the Client's communication of value objectives have affected the team delivery?

Refer to Case Study 1.

In addition; the additional respondents agreed in that the poor communication of objectives had had a negative impact on the project delivery. Succinctly put by one of them “The lack of this communication and definition has affected the delivery to date”, but there was also comment made on the role of the Project Manager in ensuring control of this aspect.

Q4.4 - Specifically for this project, how do you think the manner of Client's communication of value objectives has impacted on the approach to collaboration between the delivery team?

Refer to Case Study 1.

In addition; the respondents commented that the inherent lack of control due to the poorly communicated brief has made collaboration across the network more difficult, as people have differing views of requirement priority.

“A lack of direction is causing significant problems.”

5. Collaboration and Building Services

Q5.1 - In general, what is your view on how collaborative procurement of building services affects project outcomes when measured against "Client defined value requirements"?

Refer to Case Study 1.

In addition; the respondents all agreed that as early as possible collaboration with the supply chain should be of benefit in most project settings. But there was acknowledgement that this could mean unequitable balance against the specific Client requirements; *“Early collaboration with MEP supply chain is always of benefit. Sometimes though you trade off lower costs for technical resolutions at an earlier stage. You lose some competitive element.”* However

this does not detract from the importance of this significant aspect of the project *“MEP is the MOST important package to get tied up. SO many interfaces with this means that early engagement would benefit all projects and iron out issues. MEP is the one that needs the most thought”*.

Q5.2 - Specifically for this project, how would you describe the approach to collaborative early engagement with the Building Services supply chain?

Refer to Case Study 1.

In addition; again, some respondents were either not aware or not involved in the engagement. Those that were commented that the process worked very well, was positive, and is likely to have brought benefits to the project.

Q5.3 - Specifically for this project, what effect did the approach to collaborative early engagement with the Building Services supply chain on delivering to Client defined value requirements?

Refer to Case Study 1.

In addition; there was a degree of positivity on the impact of the engagement, even from those not directly involved; *“It has been effective. Their knowledge and experience has been key to delivery. When it’s the biggest value package, has the most interfaces and has a potential to run away from itself, it is necessary to use them effectively and develop the trust relationship. This has worked quite well on this project, so far”*. Also, in comparison to a more traditional approach; *“A lot of issues were ironed out at an earlier stage, which may not have been dealt with if we had done it in a more traditional way. I think this provides value in itself; it gives the Client technical betterment.”*

Q5.4 - Specifically for this project, in what way was the collaborative approach taken towards the Building Services Supply Chain effective?

Refer to Case Study 1.

In addition; Whilst one additional respondent was wholly positive about the effectiveness of the collaboration; *“It was effective and it sped the process up, which was needed. If this had been done under a Traditional approach, not only would it have been difficult and probably would have caused technical issues, there would have been no way we could have met the programme. The engagement and collaboration process was essential for the MEP elements meeting programme. The modular approach adopted is a good example of this. Its innovation. It adds value on a number of fronts, and it has been effective. Does the Client team recognise this? I’m not even sure they are aware we are doing it this way”*, a comment from another (who was not involved directly in the collaboration corroborates the latter part of the statement; *“I’m not sure this had quite the effect the project wanted. I know they were involved in a VE exercise but apart from that I am unaware of what affect this approach has had on the project.”*. It would appear that the impact of the collaboration is not fully understood by some.

6. Collaborative Procurement Approach Effect

Q6.1 - In comparison to the pilot case study (SJPS) Project (or others if not involved in SJPS), in what way did the alternative procurement approach taken affect this project?

Refer to Case Study 1.

In addition; the further respondents had some clear views on how the approach taken impacted on outcome and mostly in a positive sense, but some were also keen to point out the failings of some aspects of this. The comments below are included directly as they summarise thoughts clearly.

“Having the Contractor involved earlier should have realised more benefits than what we actually felt; there were some benefits but could have been

better. Some of the discussions had were disappointing, and I think we should have been having more involvement from them. I also think that there was a lack of direct communication between all team members. Some of the communications were channelled through others rather than direct. This creates better relationships and better outcomes. It was a collaboration but didn't feel fully collaborative due to some of the issues with personal connections."

Q6.2 - How did the collaborative procurement approach advocated affect trust between project participants?

Refer to Case Study 1.

In addition; similarly to the rest of the Network there were comments that it *should* have had a positive affect on the participants, but that it may have had limited impact.

"... it has helped in some areas. Relationships have been formed in the process and that is far better than a fully traditional approach."

"It was setup to be more positive and collaborative and it should have been better. Some aspects were better. However there are some key relationships which suffer from MISTRUST; this has made things really difficult. It was largely the same for St Johns, but because the roles were very clear under the wholly traditional approach there that was accepted. But this hybrid approach has probably blurred some lines in that regard and caused problems."

This last comment above is interesting in that by trying to do something which is extolled as a beneficial approach, because of people's misunderstanding on roles and responsibilities there have been issues induced. This should be counterpointed by the following comment, which seems wholly positive;

"The good dialogue and the enhanced involvement certainly helped. It would help any project, that collective effort. It builds trust, 100%. Common team approach with common goals builds relationships, enhances information flow and enhances the trust across the project." This obviously comes from a

network member who has had a wholly positive experience of the process; this is no less valid than others who have not had the same experience.

Q6.3 - How did the collaborative procurement approach advocated affect delivery to "Client defined value requirements"?

Refer to Case Study 1.

In addition; of the further network members, 2 of them believe that it had a largely positive impact overall on the project. The other 2 are less convinced and they give more guarded, less equivocal, responses. They indicate where there has been both positive and negative impacts;

"It HAS helped. Well, in my view. The early commercial engagement and collaboration on the details ironed out issues which would have manifested later in the project and would have impacted the Client."

"I'm not sure it has affected the delivery. Can see the benefits of the early engagement we have undertaken, and the Client is getting no less value out of the process or project. If it had have been purely traditional there would still be issues. The gap-filling aspect of the early engagement hasn't been particularly effective, but I think that's due to the lack of involvement. I think the people involved means that they weren't as effective in asking more probing questions and getting more out of the Client team."

As in the wider network, the responses should be considered very personal and will be affected by the position in the network and the individual's approach to this project and collaboration generally.

General Comments provided by respondents

The opportunity was afforded to those interviewed to provide general comments on the subject matter (others are noted in Appendix C). On the nature of learning from earlier project; *"Victoria benefitted from Broomhills being a bit of a guinea pig as the first project of the 3 on the park. And I feel for those involved only on Broomhills as there have been some real issues*

and some real discord between actors. That we have been able to resolve similar issues in advance here on Victoria probably means that we have better relationships; not that we don't have our problems."

D.2.4 Section 2 - The Network structure

The structure of the network being studied is expressed graphically and, in relation to key Social Network Analysis indicators, in numeric form. The two aspects considered are the *Network density* (a comparison of potential nodal links to that enacted within the network), and the *centrality* of the individual actors and as a collective.

The two key time frames of the study are represented (the 3 months prior to contract execution and the 3 months immediately following) and comparisons drawn.

Three months prior to Contract execution

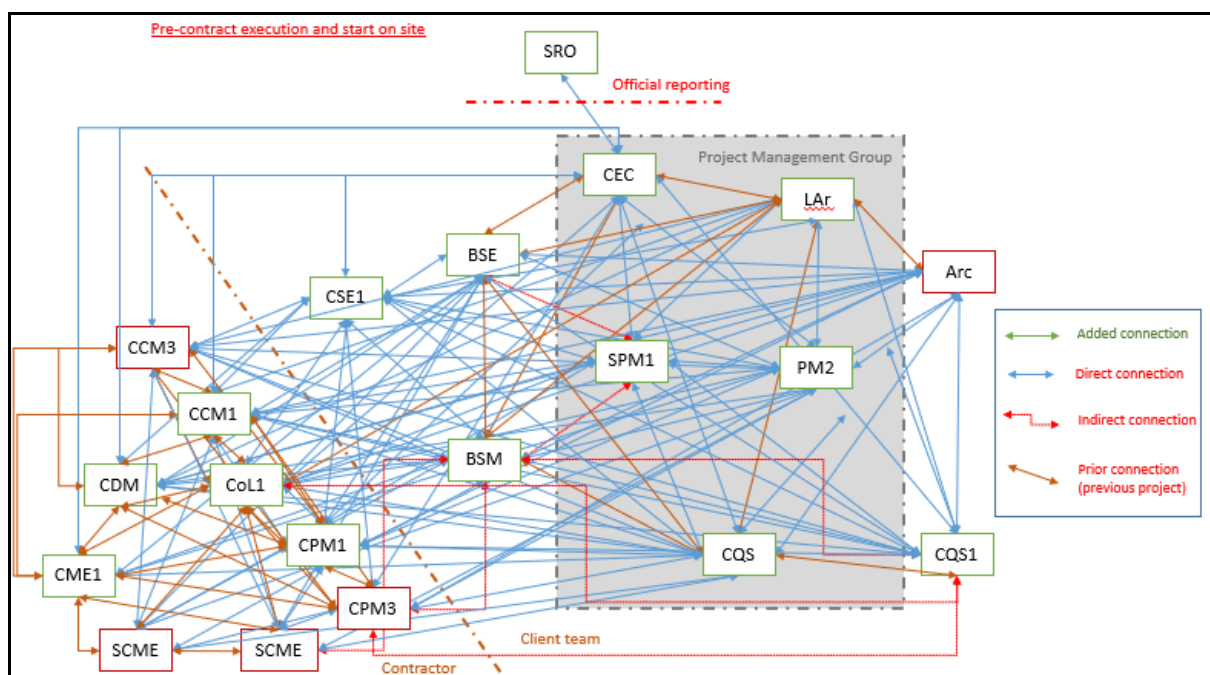


Figure D.2.1: SNA diagram – VPS, Pre-contract

Figure D.2.1 shows a quite well interconnected network with a number of connections that were already existing (previous projects and the like). The

busy-ness of the network reflects how there was a high degree of interaction at this stage, including a number of connections that are noted as being via another actor. The Project Management Group (PMG), which was the core of the Client team and project decision makers, members are situated in the grey shaded area, with *some* of the actors being the same from Case Study 0.

Network density

Number of nodes	19
Total Number of potential links	171
Number of links present	133
Network density	0.778

The network density shown here indicates a density of just below 78% (marginally higher than Case Study 1).

This reflects the interactional nature of the pre-contract obligations of the Stage 1 collaborative engagement and the *busy-ness* of the network. That it is not higher reflects a number of the network believing they were distant from some other members. Looking at the data behind this the significant areas of lack of connectivity are between the Contractor and Sub-Contractor MEP representatives (CME1, SCME) and the members of the Client team not directly involved in MEP design.

Centrality

Each actor's centrality score is noted along with a graded scale (green indicating high, red indicating low). A spread of those actors with the highest centrality, from both Client and Contractor's teams. The most significant are CPM1 and CCM1 who were driving the Contractor's engagement with the team, followed by CQS (leading commercially) and BSM (leading the MEP engagement from the Client side) . Reflecting comment above on

Client	CEC	0.806
	SPM1	0.639
	PM2	0.861
	LAr	0.806
	Arc	0.806
	CSE1	0.806
	BSM	0.972
	BSE	0.889
	CQS	0.972
	CQS1	0.806
Contractor	CoL1	0.972
	CPM1	1.000
	CPM3	0.667
	CCM1	1.000
	CCM3	0.944
	CDM	0.917
	CME1	0.694
	SCME	0.556
	SCME	0.556
	Average centrality	0.825
	Client Average	0.836
	Contractor average	0.812

the Network Density, CME1, CPM3 (largely not involved with the client team at this stage), SCME score the lowest (understandably) along with SPM1. This may indicate that whilst PM2 was leading the Project management aspects, the Senior PM representative was seen as distant or not as central to the network interactions. The relatively high centrality of the overall network and the balance between Client and Contractor average centralities should represent an active network with good communication lines.

Whilst centrality is generally referred to for individual actors within a network, the averages are included here for comparison to the second timeframe.

Three months following Contract execution

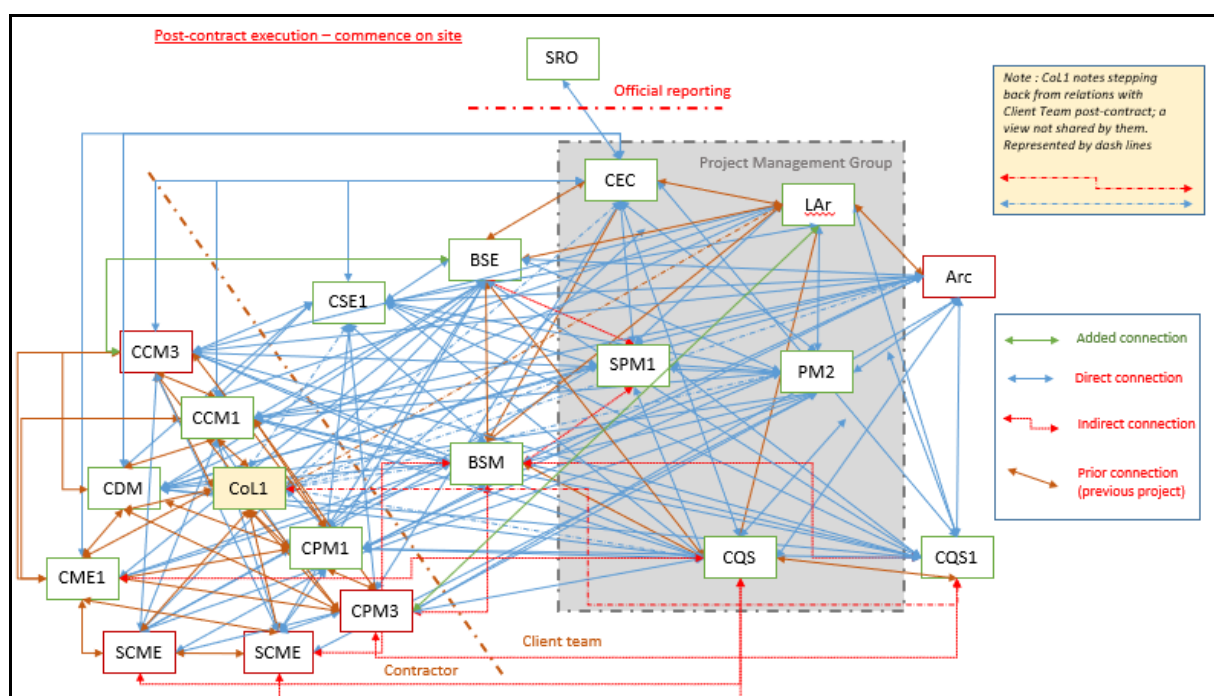


Figure D.2.2: SNA diagram – VPS, Post-contract

Figure D.2.2 is in the same format as the pre-contract version, but then reflects the changes noted from the network responses. The most notable is that CoL1 noted that he believed he stepped away from the network (from the Client side at least) once the Contract was executed. Whilst this might have been his perception, Client actors in the network still considered him being

involved. Another item of note is that the direct link between the Client commercial actors and the MEP Subcontractors was diminished, being via others.

Network density

Number of nodes	19
Total Number of potential links	171
Number of links present	126
Network density	0.737

The network density shown here indicates a density of just below 74% (higher than Case Study 1), a marginal reduction from the pre-contract period observed. This is reflective of the comment from CoL1 (reduction in present links) and the link degradation of the MEP subcontractors.

Centrality

Client	CEC	0.833
	SPM1	0.639
	PM2	0.944
	LAr	0.750
	Arc	0.806
	CSE1	0.778
	BSM	0.889
	BSE	0.917
	CQS	0.861
	CQS1	0.722
Contractor	CoL1	0.694
	CPM1	1.000
	CPM3	0.944
	CCM1	0.972
	CCM3	1.000
	CDM	0.778
	CME1	0.639
	SCME	0.611
	SCME	0.611
	Average centrality	0.810
	Client Average	0.814
	Contractor average	0.806

The two most central actors in the network changed to being CPM1 (as before) and CCM3; this reflects the slightly more prominent position of the project specific commercial management. Additionally, PM2, BSM and BSE take a higher central position which indicates potentially a higher focus on MEP aspects on this project.

The general downward trend of the centrality scores remains a factor of CoL1 being less positive towards his position in the network as others view, but it is also a reflection of the noted degradation of some relationships and the approach to the collaboration. Arguably however, centrality should have, at least, remained the same, as in the period post contract execution there should have been a similar level of collaboration to ensure the project progressed. The slight reduction in scores could also be reflective of the more traditional

approach that ensued once the (traditional) contract was enacted. In regards leadership, the two senior leadership actors (SPM1 and CoL1) score relatively lowly; could this be a factor in the effectiveness of the network in continued collaboration?

Network Density and Centrality

The two measures of a networks connectivity and activity are summarised here for the two periods considered.

	Network Density	Centrality
3 Months prior to Contract	0.778	0.825
3 Months after Contract	0.737	0.810

Comparative comments

The change between the two timeframes, it could be argued, *should* not have happened given the collaborative approach was advocated to be undertaken throughout the entire project. The reality is that the both the density and the centrality are affected by the relative positioning in two key areas;

CoL1 and their “stepping back” from the network

SCME and their direct connectivity with the Client commercial network members.

The scoring still represents a reasonably active and communicative network; the question is then around its effectiveness. This will be addressed by the responses from other aspects of the SNA questions.

Scored responses to SNA questions

It should be noted that, unlike Case Study 0, the two MEP sub-contract members of the network (SCME) are included within this element of the study as they were present throughout the period of research.

In regards the outline of questions posed, scoring methodology and outline analysis and comparison; this remains the same for all case studies and can be found in this section of Case Study 0. It is not repeated here.

D.2.5 Relative Importance Index

RII general outcomes

The data is summarised in table D.2.2 and figure D.2.3 to show the average RII response to the SNA questions for both Pre-Contract and Post-Contract periods. The shift in RII is then indicated to express if the actor had a more positive or negative view between the two periods.

	Average RII response		movement	
	Pre-Contract	Post Contract		
CEC	0.59	0.62	0.02	same or more positive
SPM1	0.77	0.74	-0.03	less positive
PM2	0.68	0.72	0.03	same or more positive
LAr	0.71	0.60	-0.12	less positive
Arc	0.72	0.68	-0.04	less positive
CSE1	0.72	0.66	-0.06	less positive
BSM	0.77	0.77	0.00	same or more positive
BSE	0.65	0.70	0.05	same or more positive
CQS	0.83	0.74	-0.09	less positive
CQS1	0.70	0.68	-0.02	less positive
CoL1	0.78	0.89	0.11	same or more positive
CPM1	0.90	0.90	0.00	same or more positive
CPM3	0.72	0.80	0.08	same or more positive
CCM1	0.87	0.89	0.02	same or more positive
CCM3	0.76	0.76	0.00	less positive
CDM	0.74	0.70	-0.04	less positive
CME1	0.73	0.73	0.00	less positive
SCME	0.85	0.82	-0.03	less positive
SCME	0.85	0.82	-0.03	less positive
Average	0.75	0.75	-0.01	less positive

Table D.2.2 : Overall RII responses

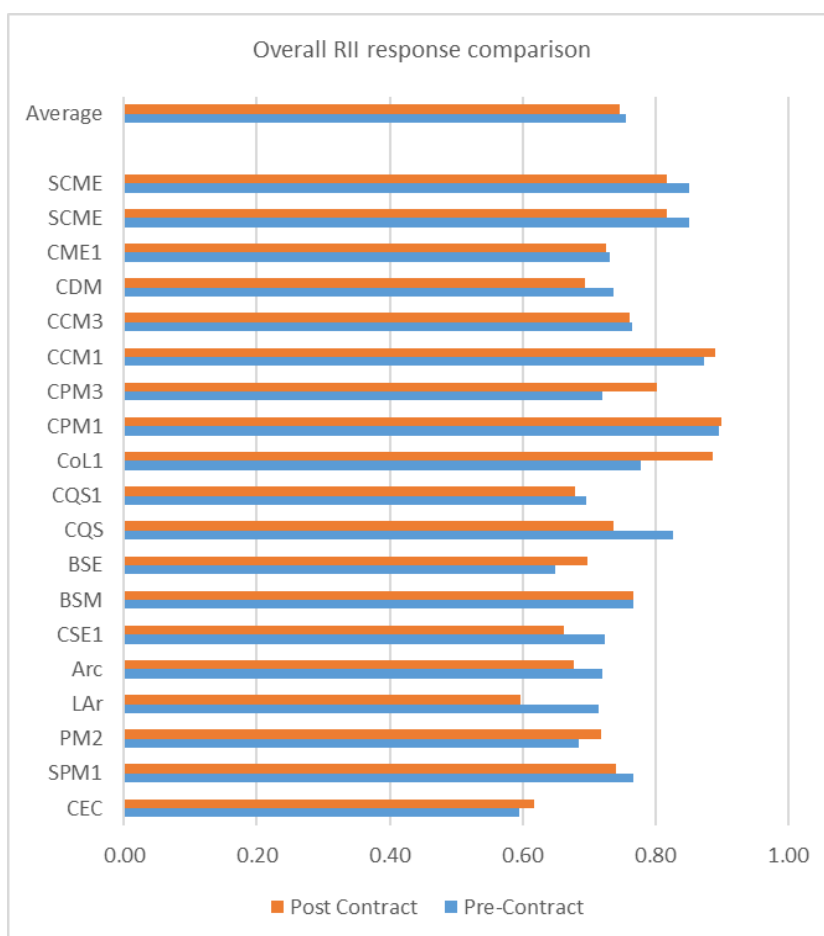


Figure D.2.3 : Overall RII response comparison

This indicates that the overall view was less positive, albeit very marginally. There are however some notable observations. Again CoL1's response is more than likely slanted due to his view of who he is scoring in the post-contract period (largely those from his own organisation). Those from the Client team, generally, have a less positive view of their scoring, some (Lar and CQS most significantly) indicating a circa 10% reduction in positivity towards the network; is this, again, reflective of the design and commercial issues that arose around contract execution? The Client (CEC) noted that they believed the pre-contract period to be more problematic than immediately after contract execution, but his scores are both relatively low; this reflects his view of the procurement's performance. The Contractor's leadership members of the network seemed to marginally improve their view on scoring, but this

could be that the pre-contract period proved problematic in their view, and they were more positive about delivery than previously. This mirrors the response from Case Study 2 (BPS). One slight difference is in the view from the MEP Designer AND the (different) MEP Subcontractor. The MEP Designers both have a more positive view post-contract, but the MEP Subcontractors are slightly less positive. Does this represent less surety following the positive engagement interaction from the Subcontractors as they move into delivery? And does this also represent more confidence in this Subcontractor from the relevant Designers? Does this divergency cause an issue? Does it represent an imbalance in the levels of trust in one another for example?

RII data distributions

Table 5.2.3.3 show that, using the RII measure, the data is a mixture between “normal” and “*not normal*” distributions, and this is reflected in the individual data analysis that follows. This does not represent an issue but has to be recognised in the data analysis. It is a factor of the data being collected from actors who express *very personal* views within the context of the SNA questions, and particularly in certain question areas. The only question that elicit a “normal” distribution both pre- and post-contract, through this measure, is in regards how each actor views Trust. This then suggests a more balanced view of the network, from the actors; it may reflect equally levels of trust (or lack of). Collaboration is split from a not-normal distribution pre-contract to a normal distribution post-contract. This might reflect the difference in opinion in how the two periods compare from different actor’s points of view. This will be further narrated in the individual response to follow.

		within 1 SD	average range from SD	distribution
TRUST	Pre-contract	79%	0.81	normal
TRUST	Post-contract	74%	0.73	normal
COLLABORATION	Pre-contract	58%	0.83	not normal
COLLABORATION	Post-contract	84%	0.83	normal
TRANSFER OF KNOWLEDGE TO ACTOR	Pre-contract	58%	0.85	not normal
TRANSFER OF KNOWLEDGE TO ACTOR	Post-contract	53%	0.87	not normal
TRANSFER OF KNOWLEDGE FROM ACTOR	Pre-contract	63%	0.82	not normal
TRANSFER OF KNOWLEDGE FROM ACTOR	Post-contract	58%	0.85	not normal
PROFESSIONAL RELATIONSHIP	Pre-contract	58%	0.82	not normal
PROFESSIONAL RELATIONSHIP	Post-contract	68%	0.83	normal

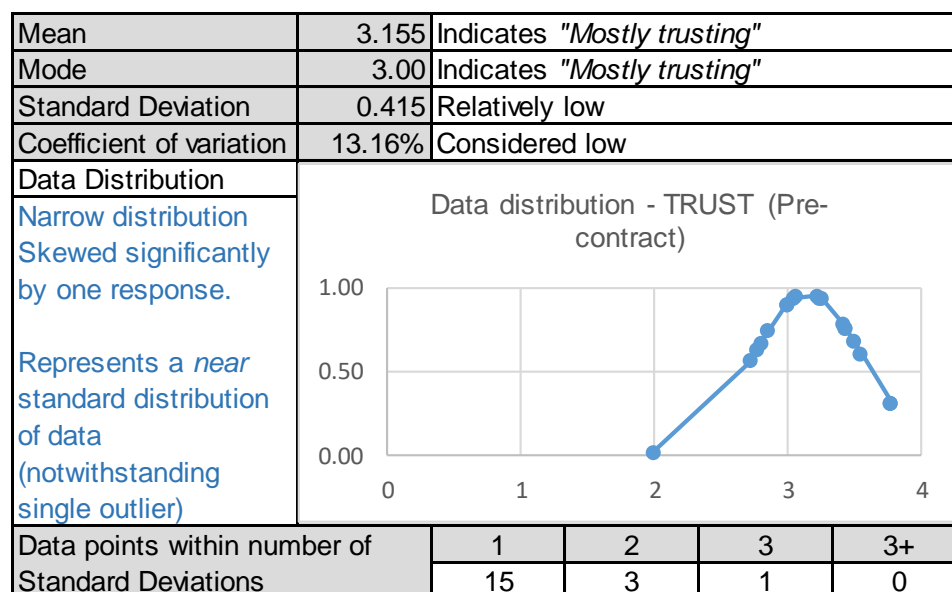
Table D.2.3 : RII data distributions

D.2.6 SNA Questions outcomes

What degree of trust do you have in each actor?

Three months prior to Contract execution

Trust (PRE): Individual scores response : *Figure D.2.6.1*



Trust (PRE): Individual reciprocal scores response : *Table D.2.6.1*

	Average Score	Average difference	Average magnitude	Difference	Magnitude
CEC	2.00	-1.28	1.28	Less trust displayed	Significant difference
SPM1	2.77	-0.89	1.33	Less trust displayed	Significant difference
PM2	2.72	-0.22	0.56	Less trust displayed	Mid-range difference
LAr	3.07	-0.39	1.06	Less trust displayed	Significant difference
Arc	2.80	-0.67	1.11	Less trust displayed	Significant difference
CSE1	3.25	-0.39	0.94	Less trust displayed	Mid-range difference
BSM	3.06	-0.22	0.67	Less trust displayed	Mid-range difference
BSE	3.27	-0.56	1.11	Less trust displayed	Significant difference
CQS	3.56	-0.28	0.39	Less trust displayed	Minimal difference
CQS1	2.86	-1.44	1.44	Less trust displayed	Significant difference
CoL1	3.22	0.33	0.67	More trust displayed	Mid-range difference
CPM1	3.78	0.61	0.61	More trust displayed	Mid-range difference
CPM3	3.43	0.39	1.06	More trust displayed	Significant difference
CCM1	3.78	0.56	0.56	More trust displayed	Mid-range difference
CCM3	3.00	0.22	0.78	More trust displayed	Mid-range difference
CDM	3.00	-0.22	0.56	Less trust displayed	Mid-range difference
CME1	3.50	1.06	1.39	More trust displayed	Significant difference
SCME	3.44	1.83	1.61	More trust displayed	Significant difference
SCME	3.44	1.83	1.61	More trust displayed	Significant difference

Observations

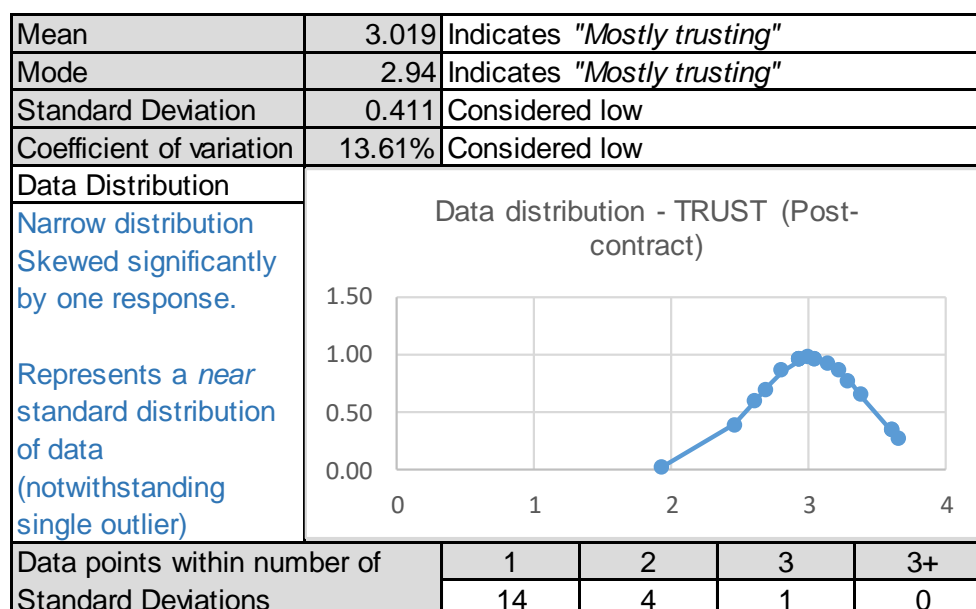
The out turn is that the respondents *mostly trusted* the network, albeit there are a number of factors in this; CEC scored significantly lower than the rest of the network whilst SCME scored relatively very much higher (highest). This could be due to their limited network connectivity, with those who they felt most able to trust. The view of the network (however limited) of trusting them was not reciprocated entirely, with them having a significantly higher view of trust within the network than was reciprocated. This impacts the *co-efficient of variation* but is somewhat tempered by some closely reciprocated views between other network members.

CME1, SPM1 and CEC also indicate significant differences in their view of other within the network, and this is considered to be due to their perceived connections (CME1 and SPM1) and general negative view of the project network from CEC.

What degree of trust do you have in each actor?

Three months following Contract execution

TRUST (POST): Individual scores response : *Figure D.2.6.2*



TRUST (POST): Individual reciprocal scores response : *Table D.2.6.2*

	Average Score	Average difference	Average magnitude	Difference	Magnitude
CEC	1.94	-1.11	1.22	Less trust displayed	Significant difference
SPM1	2.62	-0.72	1.50	Less trust displayed	Significant difference
PM2	2.94	0.44	0.78	More trust displayed	Mid-range difference
LAr	3.15	-0.17	1.06	Less trust displayed	Significant difference
Arc	2.47	-0.56	1.11	Less trust displayed	Significant difference
CSE1	2.69	-0.44	0.78	Less trust displayed	Mid-range difference
BSM	3.06	0.11	0.78	More trust displayed	Mid-range difference
BSE	3.06	0.06	0.83	More trust displayed	Mid-range difference
CQS	3.29	-0.33	0.44	Less trust displayed	Minimal difference
CQS1	2.81	-0.83	1.17	Less trust displayed	Significant difference
CoL1	3.67	-1.44	1.44	Less trust displayed	Significant difference
CPM1	3.61	0.50	0.61	More trust displayed	Mid-range difference
CPM3	3.22	0.11	0.44	More trust displayed	Minimal difference
CCM1	3.61	0.67	0.78	More trust displayed	Mid-range difference
CCM3	2.94	0.39	0.61	More trust displayed	Mid-range difference
CDM	3.00	-0.22	0.56	Less trust displayed	Mid-range difference
CME1	3.39	1.00	1.11	More trust displayed	Significant difference
SCME	2.94	1.28	1.00	More trust displayed	Mid-range difference
SCME	2.94	1.28	1.00	More trust displayed	Mid-range difference

Observations

The network generally is “mostly trusting” with some individual exceptions (CEC remains as the lowest scoring and displays less trust in others reciprocated view). SPM1 and CoL1 display the highest average magnitude differences, and this reflects their relative positions in regards “distance”. SCME, the MEP subcontractor, comes more in line with the rest of the network, but this represents a less positive view of trust in the network actors as they moved into the delivery phase. However, those enacting the leadership of the project still have positive views of trust, by and large.

Comparative observations

The movement of key measures from the data between the two time frames could indicate general trend, in the following way;

Mode	-0.06
Coefficient of variation	0.46%
Average score	-0.136
Average difference	-0.015
Average magnitude	-0.079

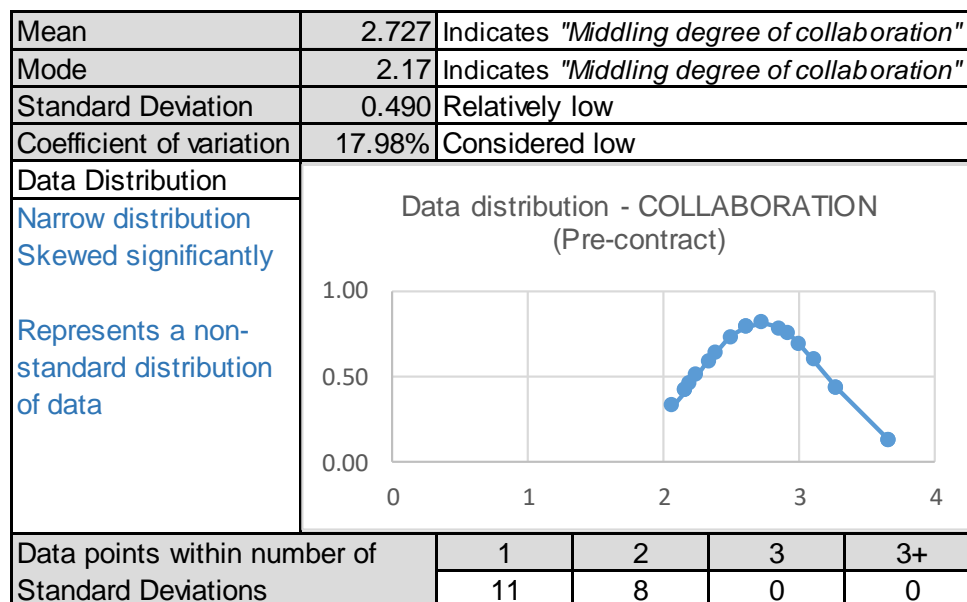
- *Mode increasing*; slightly lower trust scoring
- *Coefficient of variation*; a slightly increased difference in degree of trust
- *Average score*; generally reduced levels of trust
- *Average difference*; marginally reduced
- *Average magnitude*; decrease in the variation of difference between reciprocal scoring, more reciprocally balanced trust

The marginal increase in the Mode (but slight decrease in Mean) shows very marginal difference between the trust levels held by the network, but plainly there is some key individual scoring that effects this. The network however shows that it is more balanced in the view of trust as differences and magnitudes both reduce, so reciprocated views are likely to be closer. A lesser difference in the views of how actors trust one another is potentially a positive. Does this mean the collaborative approach HAS had a positive impact on the network in this instance; the data might indicate this.

What degree of collaboration is there with each actor?

Three months prior to Contract execution

COLLABORATION (PRE): Individual scores response : *Figure D.2.6.3*



COLLABORATION (PRE): Individual reciprocal scores response : *Figure D.2.6.3*

	Average Score	Average difference	Average magnitude	Difference	Magnitude
CEC	2.07	-0.50	0.83	Less collaborative	Mid-range difference
SPM1	2.92	-0.17	0.94	Less collaborative	Mid-range difference
PM2	2.17	-0.50	0.61	Less collaborative	Mid-range difference
LAr	3.00	0.00	0.89	More collaborative	Mid-range difference
Arc	2.73	-0.56	1.00	Less collaborative	Mid-range difference
CSE1	2.20	-1.28	1.39	Less collaborative	Significant difference
BSM	2.39	-0.44	0.89	Less collaborative	Mid-range difference
BSE	2.33	-0.94	1.17	Less collaborative	Significant difference
CQS	3.11	-0.17	0.72	Less collaborative	Mid-range difference
CQS1	2.50	-1.06	1.28	Less collaborative	Significant difference
CoL1	2.61	0.06	1.06	More collaborative	Significant difference
CPM1	3.67	0.94	1.28	More collaborative	Significant difference
CPM3	2.86	0.39	1.39	More collaborative	Significant difference
CCM1	3.67	0.94	1.28	More collaborative	Significant difference
CCM3	2.61	0.28	0.94	More collaborative	Mid-range difference
CDM	2.25	-1.00	1.11	Less collaborative	Significant difference
CME1	2.17	0.11	1.00	More collaborative	Mid-range difference
SCME	3.28	2.00	1.56	More collaborative	Significant difference
SCME	3.28	2.00	1.56	More collaborative	Significant difference

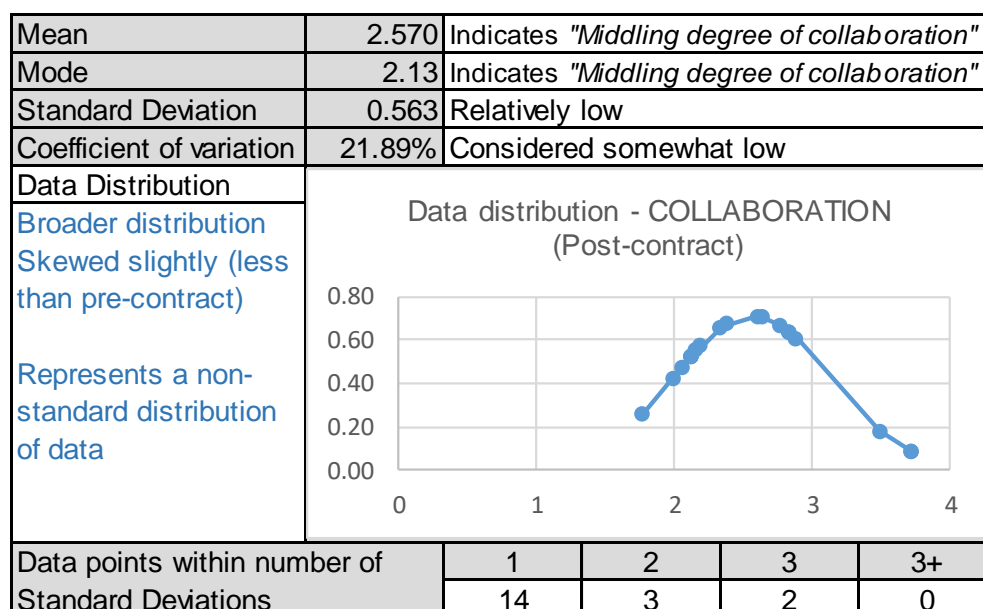
Observations

Whilst it is observed that the Mean Score indicates “Middling degree of collaboration”, it is noted that this is erring towards the “High Degree” but is impacted by a number of lower scorers. The Contractor team tend to be more positive around the scoring of collaboration (and this might be due to some limitations of their team in connectivity to Client members), whereas the Client side team are not as vociferous in this regard. Whilst SCME scored the level of collaboration higher than most others considered both BSM and BSE scored the level lower, which perhaps indicates either that the Subcontractor the collaboration was more effective or that the collaboration that BSM and BSE had with others was not as rewarding as that with the MEP supply chain.

What degree of collaboration is there with each actor?

Three months following Contract execution

COLLABORATION (POST): Individual scores response : *Figure D.2.6.4*



COLLABORATION (POST): Individual reciprocal scores response : *Table D.2.6.4*

	Average Score	Average difference	Average magnitude	Difference	Magnitude
CEC	2.13	-0.06	0.72	Less collaborative	Mid-range difference
SPM1	2.77	0.28	0.83	More collaborative	Mid-range difference
PM2	2.33	0.11	0.44	More collaborative	Minimal difference
LAr	1.77	-0.61	0.72	Less collaborative	Mid-range difference
Arc	2.20	-0.39	0.72	Less collaborative	Mid-range difference
CSE1	2.06	-0.50	0.94	Less collaborative	Mid-range difference
BSM	2.39	0.39	0.94	More collaborative	Mid-range difference
BSE	2.00	-0.56	0.89	Less collaborative	Mid-range difference
CQS	2.65	-0.22	0.67	Less collaborative	Mid-range difference
CQS1	2.13	-0.61	0.83	Less collaborative	Mid-range difference
CoL1	3.50	-1.00	1.00	Less collaborative	Mid-range difference
CPM1	3.72	1.06	1.17	More collaborative	Significant difference
CPM3	2.89	0.39	0.61	More collaborative	Mid-range difference
CCM1	3.72	1.28	1.28	More collaborative	Significant difference
CCM3	2.61	0.44	0.56	More collaborative	Mid-range difference
CDM	2.13	-0.83	0.94	Less collaborative	Mid-range difference
CME1	2.17	0.22	1.00	More collaborative	Mid-range difference
SCME	2.83	1.39	1.11	More collaborative	Significant difference
SCME	2.83	1.39	1.11	More collaborative	Significant difference

Observations

The network view appears to *tighten up* here with the number of data points within 1 SD increasing by 25%. This indicates that, largely, the view of the collaboration is more common between the actors, as a network. Plainly there are some differences in this view from individuals. The two actors with the highest “difference” are CCM1 and CPM1 (the Contractor leadership) who both indicate a higher degree of collaboration than others in the network. Subjectively, they are more likely to have to enact collaboration at this stage as they are leading the delivery stage, but the reciprocal views from the network are not equal.

Comparative observations

The movement of key measures from the data between the two time frames could indicate general trend, in the following way;

Mode	-0.04
Coefficient of variation	3.91%
Average score	-0.157
Average difference	0.108
Average magnitude	-0.231

- *Mode increasing*; slightly lower collaboration scoring
- *Coefficient of variation*; an increased difference in degree of the view of collaboration
- *Average score*; marginally reduced levels of collaboration
- *Average difference*; slightly higher reciprocal scoring.
- *Average magnitude*; reduction in the variation of difference between reciprocal scoring, more reciprocally balanced view of collaboration action.

The network seems to have a more balanced view of how it is collaborating albeit that the average score reduced very slightly (but this can be affected by a number of individual scores); a reduction in the coefficient of variation, higher reciprocal scoring, and lower average magnitude show that the

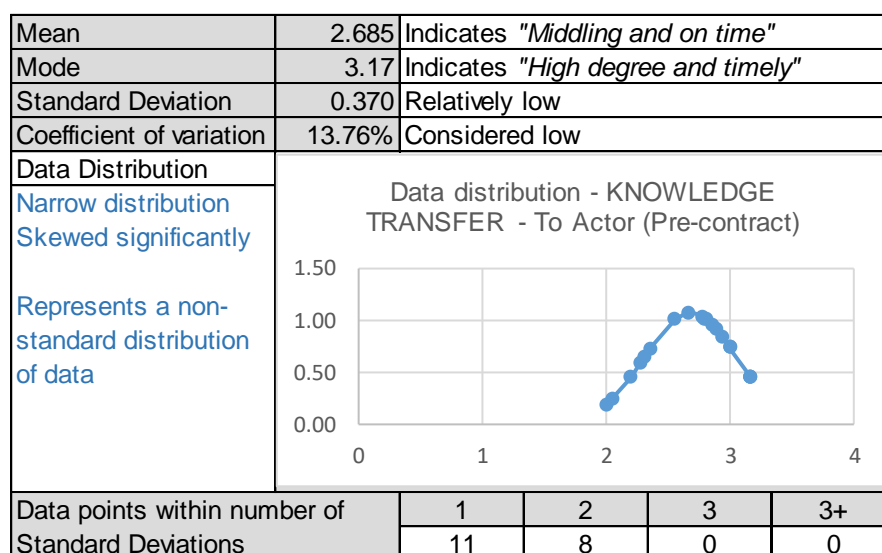
network has a more common view, but this does not mean that they believe they are all collaborating to a higher degree.

What degree of Transfer of Knowledge is there with each actor - **To actor?**

Three months prior to Contract execution

KNOWLEDGE TRANSFER TO ACTOR (PRE): Individual scores response :

Figure D.2.6.5



KNOWLEDGE TRANSFER TO ACTOR (PRE): Individual reciprocal scores response : *Table D.2.6.5*

	Average Score	Average difference	Average magnitude	Difference	Magnitude
CEC	2.00	-1.00	1.11	Less KT TO Actor	Significant difference
SPM1	3.00	-0.33	0.78	Less KT TO Actor	Mid-range difference
PM2	2.56	-0.33	0.56	Less KT TO Actor	Mid-range difference
LAr	2.36	-0.83	0.94	Less KT TO Actor	Mid-range difference
Arc	2.80	-0.56	1.00	Less KT TO Actor	Mid-range difference
CSE1	2.31	-0.67	1.11	Less KT TO Actor	Significant difference
BSM	2.94	0.11	0.44	More KT TO Actor	Minimal difference
BSE	2.20	-1.06	1.28	Less KT TO Actor	Significant difference
CQS	2.67	-0.17	0.83	Less KT TO Actor	Mid-range difference
CQS1	2.29	-1.22	1.67	Less KT TO Actor	Significant difference
CoL1	2.89	0.44	0.78	More KT TO Actor	Mid-range difference
CPM1	3.17	0.56	1.00	More KT TO Actor	Mid-range difference
CPM3	2.86	0.22	1.33	More KT TO Actor	Significant difference
CCM1	3.00	0.39	0.83	More KT TO Actor	Mid-range difference
CCM3	2.78	0.61	0.83	More KT TO Actor	Mid-range difference
CDM	2.81	0.22	0.89	More KT TO Actor	Mid-range difference
CME1	2.06	0.06	1.28	More KT TO Actor	Significant difference
SCME	3.17	1.94	1.56	More KT TO Actor	Significant difference
SCME	3.17	1.94	1.56	More KT TO Actor	Significant difference

Observations

The requirements of a procurement approach such as was undertaken here would lend themselves to a necessity for a high degree of Knowledge Transfer; the 2 stage approach positively involves it. But the scoring from the network intimates that the transfer of knowledge TO other actors was merely “middling” (albeit it is erring *towards* a high degree), but at least it was “on time”. There is a, more or less, definitive split between the Client and Contractor teams within the network; with the Client actors nominally stating that there was less transfer TO other actors, with the Contractor actors being the reciprocal of that. As a collaborative process with design reviews and market testing (alongside the MEP collaborative workshops) being undertaken in this period, this *should* be the case as a high degree of information should be transferring from Contractor TO Client.

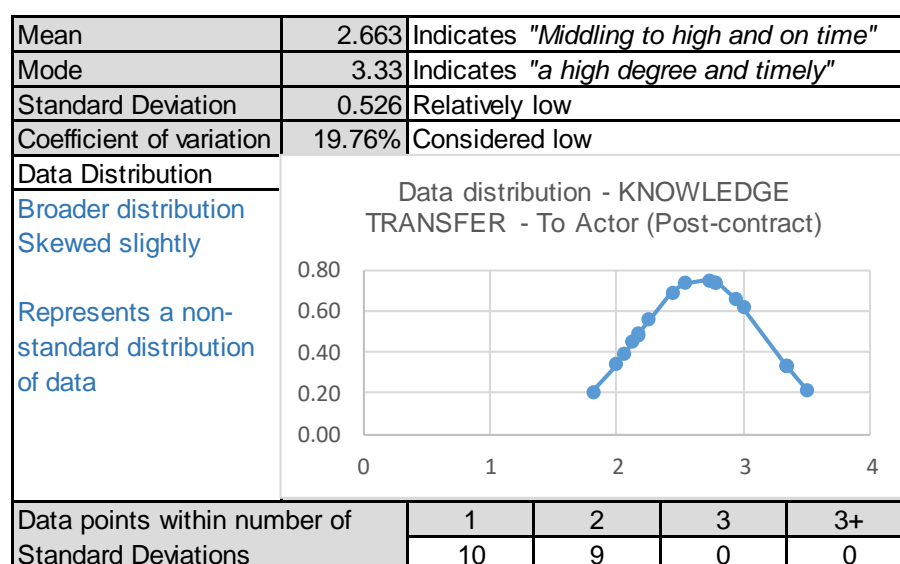
There are other actors (BSE and CME1), both involved in the MEP collaboration who’s view on scoring significantly differed from others in the network, which lends itself to them having a separate, personal, view of how effective the knowledge transfer may have been. CQS1 had the highest average magnitude difference; but this was most likely due to their view what they were undertaking in the pre-contract phase; they were not involved in a number of the activities.

What degree of Transfer of Knowledge is there with each actor - To actor?

Three months following Contract execution

KNOWLEDGE TRANSFER TO ACTOR (POST): Individual scores response :

Figure D.2.6.6



KNOWLEDGE TRANSFER TO ACTOR (POST): Individual reciprocal scores response : *Table D.2.6.6*

	Average Score	Average difference	Average magnitude	Difference	Magnitude
CEC	2.13	-0.72	1.28	Less KT TO Actor	Significant difference
SPM1	2.77	-0.17	0.94	Less KT TO Actor	Mid-range difference
PM2	2.72	0.00	0.67	More KT TO Actor	Mid-range difference
LAr	2.00	-1.33	1.33	Less KT TO Actor	Significant difference
Arc	2.53	-0.56	1.33	Less KT TO Actor	Significant difference
CSE1	2.25	-0.61	1.28	Less KT TO Actor	Significant difference
BSM	2.94	0.33	0.44	More KT TO Actor	Minimal difference
BSE	2.17	-0.44	0.89	Less KT TO Actor	Mid-range difference
CQS	2.18	-0.28	0.72	Less KT TO Actor	Mid-range difference
CQS1	1.81	-0.78	1.33	Less KT TO Actor	Significant difference
CoL1	3.50	-1.22	1.33	Less KT TO Actor	Significant difference
CPM1	3.33	0.67	0.89	More KT TO Actor	Mid-range difference
CPM3	3.00	0.33	0.89	More KT TO Actor	Mid-range difference
CCM1	3.33	0.89	0.89	More KT TO Actor	Mid-range difference
CCM3	2.78	0.50	0.50	More KT TO Actor	Minimal difference
CDM	2.44	-0.39	1.17	Less KT TO Actor	Significant difference
CME1	2.06	-0.11	1.56	Less KT TO Actor	Significant difference
SCME	3.33	1.94	1.39	More KT TO Actor	Significant difference
SCME	3.33	1.94	1.39	More KT TO Actor	Significant difference

Observations

The relative transfer of knowledge no longer seems to be reliant on whether Client or Contractor with a variety of views of how much knowledge is being transferred to other network members. This should be the case given the activities immediately following contract execution; there should be a high degree of transfer of knowledge as key activities kick off and the construction commences, raising queries etc. CME 1 continues to have a high magnitude difference (but a low average difference) between themselves and other actors which represents that a significant number do not believe there is knowledge being transferred effectively TO that actor. SCME has a high average difference and magnitude; this indicates they believe themselves to be transferring more knowledge to others than a significant number of the network believe. This disparity might indicate that a proportion of the network are not party to the information that is being issued by the MEP subcontract and supply chain.

Comparative observations

The movement of key measures from the data between the two time frames could indicate general trend, in the following way;

Movement from Pre to Post Contract	
Mode	0.02
Coefficient of variation	-5.99%
Average score	-0.022
Average difference	-0.018
Average magnitude	0.023

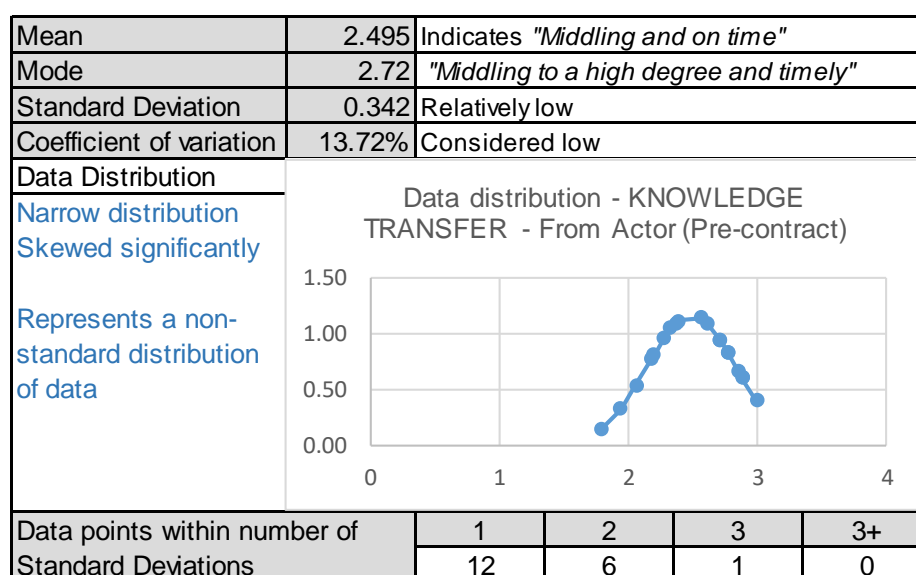
- *Mode increasing*; slightly higher scoring
- *Coefficient of variation*; an increased difference in degree of Knowledge Transfer
- *Average score*; slightly reduced levels of Knowledge Transfer
- *Average difference*; slight reduction in network
- *Average magnitude*; slight increase in the variation of difference between reciprocal scoring, slightly less reciprocally balanced view of Knowledge Transfer TO actors.

The network scoring between the two periods did not change a great deal, there were very slight adjustments in the comparisons made. The coefficient of variation increasing somewhat may indicate that there was a view that transfer of knowledge TO other actors in the network was less widespread following contract execution. This could be due to the activities being undertaken with the broader team and the enhanced involvement of the delivery team members that might have had less involvement in the pre-contract period.

What degree of Transfer of Knowledge is there with each actor - **From actor?**

Three months prior to Contract execution

KNOWLEDGE TRANSFER FROM ACTOR (PRE): Individual scores response
: Figure D.2.6.7



KNOWLEDGE TRANSFER FROM ACTOR (PRE): Individual reciprocal scores response : Table D.2.6.7

	Average Score	Average difference	Average magnitude	Difference	Magnitude
CEC	1.80	-0.78	0.89	Less KT FROM Actor	Mid-range difference
SPM1	2.62	-0.28	0.94	Less KT FROM Actor	Mid-range difference
PM2	2.39	0.00	0.78	More KT FROM Actor	Mid-range difference
LAr	2.29	-0.56	0.67	Less KT FROM Actor	Mid-range difference
Arc	2.20	-0.83	1.06	Less KT FROM Actor	Significant difference
CSE1	2.19	-0.56	0.89	Less KT FROM Actor	Mid-range difference
BSM	2.89	0.44	0.67	More KT FROM Actor	Mid-range difference
BSE	2.07	-0.83	0.94	Less KT FROM Actor	Mid-range difference
CQS	2.89	0.00	0.44	More KT FROM Actor	Minimal difference
CQS1	2.57	-0.83	1.17	Less KT FROM Actor	Significant difference
CoL1	2.33	0.06	0.83	More KT FROM Actor	Mid-range difference
CPM1	3.00	0.39	0.72	More KT FROM Actor	Mid-range difference
CPM3	2.86	0.50	1.17	More KT FROM Actor	Significant difference
CCM1	2.72	0.33	0.67	More KT FROM Actor	Mid-range difference
CCM3	2.72	0.72	0.72	More KT FROM Actor	Mid-range difference
CDM	2.38	-0.50	0.50	Less KT FROM Actor	Minimal difference
CME1	1.94	-0.11	1.00	Less KT FROM Actor	Mid-range difference
SCME	2.78	1.50	1.11	More KT FROM Actor	Significant difference
SCME	2.78	1.50	1.11	More KT FROM Actor	Significant difference

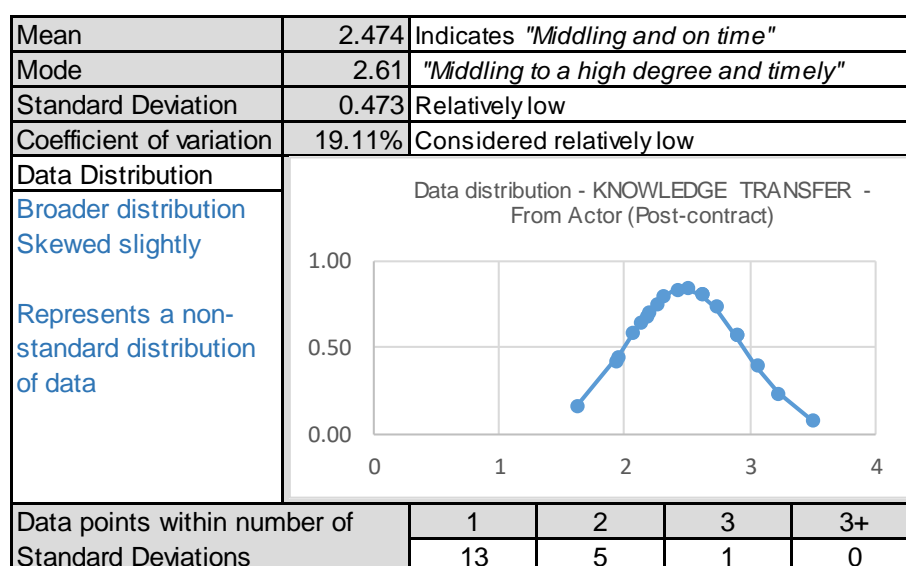
Observations

The network suggest that Knowledge transfer FROM other actors is very much *middling* and is less when compared to that transferred TO other actors in the pre-contract period; this indicates that, in general, the actors perceive that they are contributing more to the transfer of knowledge than those who should be transferring knowledge to them. In relation to building services, the actors involved in the pre-contract engagement provide a range of responses. Whilst, again, the MEP subcontractors (SCME) score highly, indicating that they perceived a high degree of information, the Designers (BSM and BSE) scored differently, and the Building Services Manager (CME1) score significantly lower, with high degrees of magnitude of divergent scoring. This represents a significant difference in views from those involved and could indicate an issue in itself on the consistency of the respondents. However, taking the scores on face value would intimate that the subcontractors believe that information was suitable and available, whilst those working with them believe that not to be the case. We should remind ourselves here on comments made in the interviews where some thought the MEP interaction to be a positive, whilst others had reservations on its benefits (or they were not involved); these two sources of data appear to support one another.

What degree of Transfer of Knowledge is there with each actor - From actor?

Three months following Contract execution

KNOWLEDGE TRANSFER FROM ACTOR (POST): Individual scores response : *Figure D.2.6.8*



KNOWLEDGE TRANSFER FROM ACTOR (POST): Individual reciprocal scores response : *Table D.2.6.8*

	Average Score	Average difference	Average magnitude	Difference	Magnitude
CEC	2.19	-0.22	1.00	Less KT FROM Actor	Mid-range difference
SPM1	2.31	-0.28	0.72	Less KT FROM Actor	Mid-range difference
PM2	2.50	0.17	0.72	More KT FROM Actor	Mid-range difference
LAr	1.92	-0.89	0.89	Less KT FROM Actor	Mid-range difference
Arc	2.07	-0.56	0.89	Less KT FROM Actor	Mid-range difference
CSE1	1.63	-0.83	1.06	Less KT FROM Actor	Significant difference
BSM	2.89	0.72	0.72	More KT FROM Actor	Mid-range difference
BSE	2.17	-0.17	0.72	Less KT FROM Actor	Mid-range difference
CQS	2.41	-0.17	0.61	Less KT FROM Actor	Mid-range difference
CQS1	2.25	-0.39	1.06	Less KT FROM Actor	Significant difference
CoL1	3.50	-1.00	1.11	Less KT FROM Actor	Significant difference
CPM1	3.22	0.56	0.56	More KT FROM Actor	Mid-range difference
CPM3	2.89	0.17	0.39	More KT FROM Actor	Minimal difference
CCM1	3.06	0.61	0.61	More KT FROM Actor	Mid-range difference
CCM3	2.72	0.50	0.50	More KT FROM Actor	Minimal difference
CDM	2.13	-0.61	0.72	Less KT FROM Actor	Mid-range difference
CME1	1.94	-0.06	1.06	Less KT FROM Actor	Significant difference
SCME	2.61	1.22	0.83	More KT FROM Actor	Mid-range difference
SCME	2.61	1.22	0.83	More KT FROM Actor	Mid-range difference

Observations

Notwithstanding CoL1's scoring (and has been previously noted his view on his position in the network post-contract), other marked actors with high magnitude differences are CEC (might be expected given the post contract activities the client would be directly involved in), CSE1 (at this stage a high proportion of the structural information may have already been dealt with between the various actors involved in their discipline), CQS1 (likely to be less information coming from the QS involved), and CME1 (unclear as to why this should be given the nature of coordination of building services required as the build process commences)

Comparative observations

The movement of key measures from the data between the two time frames could indicate general trend, in the following way;

Movement from Pre to Post Contract	
Mode	-0.11
Coefficient of variation	5.38%
Average score	-0.021
Average difference	-0.009
Average magnitude	-0.067

- *Mode decreasing*; lower Knowledge Transfer scoring
- *Coefficient of variation*; an increased difference in degree of Knowledge Transfer
- *Average score*; generally, marginally, decreased levels of Knowledge Transfer
- *Average difference*; virtually no change in reciprocal scoring
- *Average magnitude*; slight decrease in the variation of difference between reciprocal scoring, more reciprocally balanced view of Knowledge Transfer

There were very slight differences between the two periods, with the most notable change being the increase in the coefficient of variation. This indicates a widening of the view between the individuals of the network; the other smaller changes are likely to mean that the coefficient value is being

impacted by one or more significant actor's scores. The slightly lesser scoring indicates that, generally the network considers there is less knowledge forthcoming from the rest of the network following contract execution. With a collaborative procurement approach this is likely to be anticipated, and perhaps the difference *should* be higher.

When comparing the TO ACTOR to FROM ACTOR responses the following is observed.

	TO Actor			FROM Actor		
	pre	post	m'ment	pre	post	m'ment
Mean	2.68	2.66	-0.02	2.49	2.47	-0.02
Mode	3.17	3.33	0.17	2.72	2.61	-0.11

Table D.2.6.8.1 Knowledge transfer comparison

From this it appears that in regards knowledge transfer TO other network actors, there is an aberration in the Modal measure in how it is inferring an improvement in this rather than what the mean indicates. From this, it may be inferred that there are differing views within the network on the change in effective knowledge transfer, although the further indications within the data set to show that a number of the actors scoring was more positive between the two periods.

In regards FROM other network actors, there is a negative indication. This then, however slightly, indicates that generally the actors consider themselves to be transferring more knowledge than they are receiving from others in the network. It cannot be the case that is happening practically.

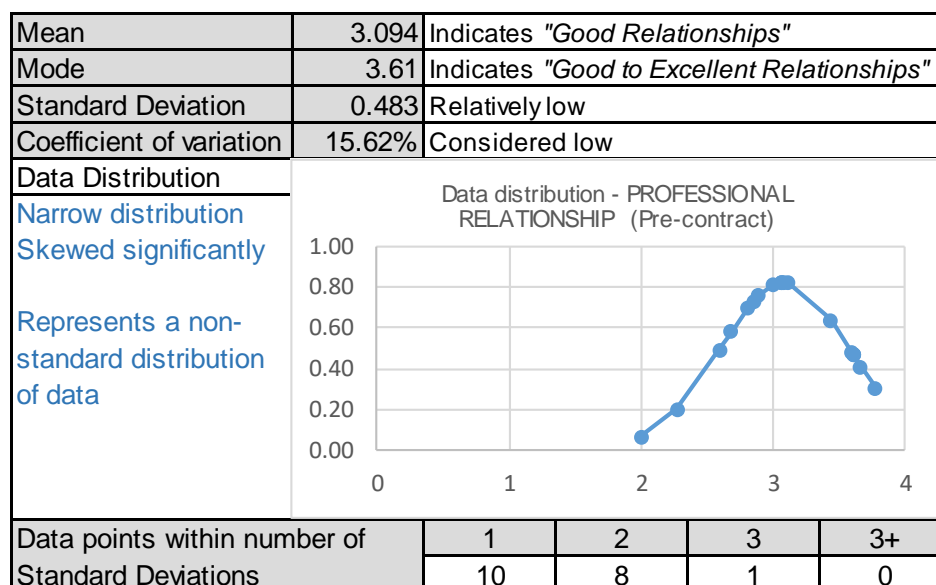
That the data represents a confused situation may be representative of the personal responses, driven by the context of the events both leading up to contract execution (where relationships were fraught) and the pressures of enacting the site activities once the contract was executed. It is also potentially a factor of the nature how individuals view the strength and validity of their professional input into project teams.

What is the manner of relationship between yourself and each actor?

Three months prior to Contract execution

PROFESSIONAL RELATIONSHIP (PRE): Individual scores response : *Figure*

D.2.6.9



PROFESSIONAL RELATIONSHIP (PRE): Individual reciprocal scores response : *Table D.2.6.9*

	Average Score	Average difference	Average magnitude	Difference	Magnitude
CEC	2.00	-1.33	1.33	Less positive	Significant difference
SPM1	3.08	-0.61	1.06	Less positive	Significant difference
PM2	2.28	-0.94	1.17	Less positive	Significant difference
LAr	3.07	-0.50	0.83	Less positive	Mid-range difference
Arc	2.60	-0.94	1.17	Less positive	Significant difference
CSE1	2.81	-0.83	1.06	Less positive	Significant difference
BSM	2.89	-0.22	0.67	Less positive	Mid-range difference
BSE	3.60	-0.11	1.22	Less positive	Significant difference
CQS	3.44	-0.17	0.39	Less positive	Minimal difference
CQS1	3.07	-1.11	1.44	Less positive	Significant difference
CoL1	3.11	0.22	0.89	More positive	Mid-range difference
CPM1	3.78	0.72	0.72	More positive	Mid-range difference
CPM3	2.86	0.17	1.28	More positive	Significant difference
CCM1	3.67	0.61	0.72	More positive	Mid-range difference
CCM3	3.00	0.39	0.94	More positive	Mid-range difference
CDM	2.69	-0.44	0.89	Less positive	Mid-range difference
CME1	3.61	1.28	1.28	More positive	Significant difference
SCME	3.61	2.06	1.56	More positive	Significant difference
SCME	3.61	2.06	1.56	More positive	Significant difference

Observations

With a mean suggesting that the relationships are generally good, this refutes (to a degree) some of the comments made in the interviews. However, it is noted that just because one actor may not necessarily trust another, the “professional” relationship may still be relatively effective. actors of note in the scoring are CEC, who scored comparatively lower against the rest of the network. This intimates that they felt that their professional relations were merely *fair*. Given that 2.00 is their average score, one must note that a significant proportion would have been scored as *poor* or even *extremely poor*.

Others of note are BSE, who viewed their relationship with others consistently higher, and CME1, who had a variety of differences in scoring. Both these actors interacted, in regards Building Services, with SCME who considered that their relationships in the network were *good to excellent*, with minimal difference in scoring from other actors. This supports other elements within the case study whereby the interaction of those involved in early engagement in regards the Building Services was viewed positively.

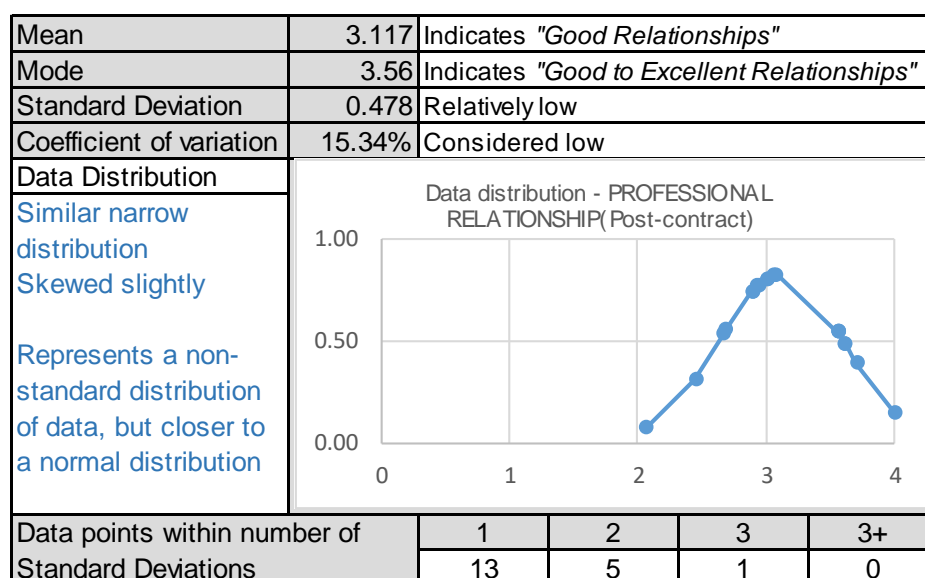
A general view would indicate that the Client team felt less positive in regards professional relationships than that of the Contractor team. One exception is CDM (Contractor’s Design Manager) who voiced the same view within interview having felt that some relationships were poor to the point of being obstructions to the delivery.

What is the manner of relationship between yourself and each actor?

Three months following Contract execution

PROFESSIONAL RELATIONSHIP (POST): Individual scores response :

Figure D.2.6.10



PROFESSIONAL RELATIONSHIP (POST): Individual reciprocal scores response : Table D.2.6.10

	Average Score	Average difference	Average magnitude	Difference	Magnitude
CEC	2.06	-1.06	1.39	Less positive	Significant difference
SPM1	3.08	-0.39	1.28	Less positive	Significant difference
PM2	2.44	-0.50	0.83	Less positive	Mid-range difference
LAr	2.93	-0.56	1.00	Less positive	Mid-range difference
Arc	2.67	-0.61	1.06	Less positive	Significant difference
CSE1	2.94	-0.39	0.94	Less positive	Mid-range difference
BSM	2.89	0.00	0.78	More positive	Mid-range difference
BSE	3.06	0.06	0.83	More positive	Mid-range difference
CQS	3.71	0.00	0.22	More positive	Minimal difference
CQS1	3.00	-0.72	1.17	Less positive	Significant difference
CoL1	4.00	-1.39	1.50	Less positive	Significant difference
CPM1	3.61	0.50	0.72	More positive	Mid-range difference
CPM3	2.89	-0.28	0.50	Less positive	Minimal difference
CCM1	3.56	0.61	0.83	More positive	Mid-range difference
CCM3	3.00	0.11	0.78	More positive	Mid-range difference
CDM	2.69	-0.56	1.00	Less positive	Mid-range difference
CME1	3.61	1.28	1.28	More positive	Significant difference
SCME	3.56	1.94	1.56	More positive	Significant difference
SCME	3.56	1.94	1.56	More positive	Significant difference

Observations

Still considered as “Good” relationships based on the Mean response, despite the Mode score indicating a somewhat lesser view. CEC considered that relationships improved in general terms following contract execution, which indicates that their view of the pre-contract period was less than positive. Those involved in the Building Services aspects all score highly reflecting the work undertaken in this area and the relationships required. CoL1 potentially an outlier given their view of position in the network compared to others’ view. The delineation made between client and contractor in the pre-construction period on the positivity towards the relationships is degraded somewhat by a number of differing views on this.

Comparative observations

The movement of key measures from the data between the two time frames could indicate general trend, in the following way;

Movement from Pre to Post Contract	
Mode	-0.06
Coefficient of variation	-0.28%
Average score	0.024
Average difference	-0.015
Average magnitude	-0.050

- *Mode decreasing*; slightly lower scoring of the wider network
- *Coefficient of variation*; a very slightly decreased difference in degree of view of relationship
- *Average score*; minimal increase of scoring
- *Average difference*; minimal change in reciprocal scoring
- *Average magnitude*; minimal decrease in the variation of difference between reciprocal scoring, more reciprocally balanced view of the relationships

As a network there was very little change in view of the quality of the professional relationships between the two periods, but overall the MEAN scoring increased very slightly. The pre-construction period and the activities

involved meant that some actors HAD to interact more closely, whereas once the contract was executed this may not have been the case. Whilst still professionally linked, it could be that there was a conscious or sub-conscious slight change between some of the network links. If we then consider the MODE (-0.06) and the MEAN (0.024), there appears to be a potential discrepancy and taking the values to be indicative, one might suggest a marginal decrease (-0.036) in positivity towards the relationships. This is reflected in the RII score earlier in the case study, with a very slightly less positive view.

D.2.7 Case Study Summary

It was surmised by some actors responses that this project would benefit from the lessons learned of the initial project (BPS). However it would appear this might not have been the case, at least not in the timeframe being reviewed. There were some issues still noted within the interviews and in the scoring provided; this might be expected given the high degree of commonality in some of the network.

Refer to case study 1 (BPS) for summary comments as they are largely the same.

In terms of summarising the response to the over-arching research questions, table D.2.6.11 provides this.

Research Question topic	Case Study position
Levels of Trust	Defined as "Mostly Trusting", reducing post contract
Degree of Collaboration	A "middling to high degree" of collaboration, reducing post contract
Extents of Knowledge Transfer	A "middling and on time" view generally, both pre and post contract. Individuals appear to see themselves transferring more TO others than they get FROM others.
Professional Relationship of the Network	"Good" both pre and post contract, with a very slight increase after contract execution.
Client Objectives defined	Noted as being an "essential" requirement. Poor definition of objectives with some commenting on this not being provided with any clarity (i.e. not in written form). Confusion apparent from the network and this caused issues within the activities, and that this may be due to objectives being "perception based".
Building Services Procurement	Those involved in the early engagement provide positive comments on this aspect and note that without this being undertaken, delivery to development programme would have been impossible. Trust, Collaboration, Knowledge Transfer and professional relationships generally score higher within the network from those involved in this aspect.

Table D.2.6.11 : Case Study position summary

D.3 Case Study 3 – Canaan Lane Primary School (CLPS)



D.3.1 Case study outline

Canaan Lane Primary School, Edinburgh (CLPS) is situated in the Morningside area of central Edinburgh. This new school was to deal with a number of additional capacity issues of surrounding schools in a catchment review. The site had a care home (which was to be demolished) and a small school annex which was to be developed along with the new school provision.

CLPS (including the existing annex building) was to be a 2-stream Primary school (7 years, 462 pupils) with a 60-place nursery included, along with landscaped areas. The site was heavily constrained in its extents and was also subject to restricted access and egress due to local road systems.

The CEC applicable Frameworks to this research: *Refer to Case Study 1*

Project Approach: *Refer to Case Study 1*

The Project development followed the same process as BPS. Refer to Table D.3.1 for timeline and values and refer to *Case Study 1* for narrative.

Stage	Date	Value	Building Services %	Comments
Stage 2	05/04/18	£9,682,000	28%	Outline design which had significant architectural requirements
Stage 3	23/05/19	£10,915,000	26%	Developed design with Client additions
Stage 4	20/09/19	£11,432,000	25%	Update at this stage only as engagement with Contractor has commenced.
Contract	17/02/20	£12,258,000	25%	Following full Work Package Market response and Enabling Works
Completion / FA	Current projection	£14,914,000	23%	Significant change, delay and other factors increase overall cost. MEP % reduction due to allocation of these change costs (but MEP HAS increased).

Table D.3.1 - Key milestones and values

D.3.2 Notable events/issues in delivery

A number of events or issues that are relevant to the case study are included here.

Refer to Case Study 1.

In addition

- i. The issues encountered on Case Study 1 regarding Building Warrant were not as significant on this project but were still an issue. They were minimised by the agreement to undertake enabling works, consisting of demolition of the existing care home and some other groundworks.
- ii. When the further groundworks and excavations for the foundations commenced numerous uncharted services were discovered which caused delays and concern. Coupled with this was the ground bearing conditions which proved incompatible with the design (the design not being fully informed by ground investigations under the existing facility). These two issues added significant time and costs to the project.
- iii. CLPS benefitted from some *lessons learned* from BPS (case study 1) given that it started construction afterwards. There still remained issues

as outlined elsewhere in the communication around design aspects which put significant pressure on delivery and the project team.

- iv. Discussions over the extents of the MEP design at pre-construction and what the Subcontractor should have taken account of during their engagement-informed pricing exercise remain ongoing and have added costs to project.
- v. At the time of writing, following numerous delays, CLPS is due to reach completion and be handed over to CEC. The works to the annex building have not yet commenced.

D.3.3 Section 1 – Interview Questions

1. Trust and project delivery

Q1.1 - In general, what is your view on trust and the role it plays in project delivery?

Refer to Case Study 1.

In addition; the different actors agreed that it was “*pretty key*”, “*huge*” and “*has a major role and is required to build efficiencies within projects, teams and environments*”. One actor stated, “*No trust, no disclosure, no point*”. Another, linking to other aspects of the questions, commented “*It helps with collaboration and being able to rely on others to deliver. Having no trust is detrimental to projects.*”

A final comment on the counterpoint to trust :

“*Suspicion is also inherent, which drives standards and inefficiencies. There are two sides to the trust coin.*”

Q1.2 - Specifically for this project, how do you think the level of trust between the actors had an impact on Delivery?

Refer to Case Study 1.

In addition;

There were some different points made by those responding; whilst one identified that *“there has been a reasonable level of trust. Less people fighting their own corner”*, others noted that whilst there was a reasonable level of trust between some of the network members to get to the point of Contract execution, it wasn't the full team and that there were some issues being encountered in the delivery phase. They were agreed it is a significant factor on this project, and has *“had a huge impact, especially at pre-construction and the tendering stages. Trust was at its highest in that period.”*

Q1.3 - Specifically for this project, what level of trust do you think was active between the actors?

Refer to Case Study 1.

In addition; One actor noted that there had been some good examples of where there had been positives in trust levels, which was supported by others when they focused on key relationships (both internally and externally). However, there were other observations on the operational trust aspects with some actors not doing what they said they will do in a timely way. This *“caused issues; they were resolved over time, but the trust is harder to instil”*.

It seems a universal view that the levels of trust have differed across the network. Whilst *“Cost variations and negotiations have been reliant on the trust relationship being there. And it still is”*, other less trusting relationships have been *“impacted by abilities and timely delivery. Some of the information or lack of it have caused a diminishment of trust between some of the team, both up and down supply/demand chain.”*

2. Trust and knowledge transfer

Q2.1 - In general, what is your view on the role of trust in the transfer of Project knowledge?

Refer to Case Study 1.

In addition; the additional actors agreed that *“Trust is required to make sure suitable knowledge is transferred”* and that it was *“critical to success on any project”*. There was consensus that knowledge transfer is *“generally better when there is a high degree of trust. The certainty of knowledge is more relied on with no hidden agendas.”*

Q2.2 - Specifically for this project, how do you think the level of trust between the actors had an impact on the transfer of key knowledge?

Refer to Case Study 1.

In addition; the view was that there were instances where it did work well and the trust relationships within that process helped significantly. This was tempered by it being stated that it was not consistent across the network or throughout the programme; it might have started well, but at later times it has become *“less effective and that has been when we have had to really rely on wider trust relationships to ensure knowledge is available”*.

It was commented that there had been benefits through the knowledge transfer from the earlier projects (both BPS and VPS) and the issues encountered.

Q2.3 - Specifically for this project, how effective was the transfer of key knowledge?

Refer to Case Study 1.

In addition; the additional actors acknowledged that there had been degrees of effectiveness, i.e. it had been good and bad, despite comments made in response to earlier questions. *“It has been effective to a degree, some good works initially, but there have been some failings in some of the*

communication around design details etc. following lessons learned. It certainly could have been done better.”

One actor was quite clear on there being some very specific examples of highly effective transfer of knowledge in different areas of the network and further into the supply chain, and this was particularly helpful as problems were encountered.

3. Differing inter-actor perception of trust

Q3.1 - In general, what is your view on the perception of differing levels of trust between construction project actors, and how this affects inter-project relationships?

Refer to Case Study 1.

In addition; one actor noted that on an *individual relationship basis*, if not resolved and then leading to numerous trust-based issues, it is likely to put any relationship in serious jeopardy. Another actor noted the scalability of the issue of disparity, *“the bigger the variation in perception of trust levels the larger the impact on the relationship”* inferring that issues become greater as they get further from a balanced trust relationship.

“Imbalance always causes tension and problems” said another actor, who went on to note the intractable nature of loss of trust in this context; *“When we start with a balanced trusting relationship and then something happens to place that in an imbalance, the project relationships deteriorate potentially to the point where they are not recoverable”*

Q3.2 - Specifically for this project, what is your view on how different perceptions of the levels of trust between actors affected relationships?

Refer to Case Study 1.

In addition;

One actor simply said that they were not aware of any discrepancies of this nature. This is significantly at odds with others who stated *“In this project*

there is a wide variation in the levels of trust between a number of the wider team and it is and has had a significant impact on the relationships. Some key team members have shown an undercurrent of distrust, which undermines the entire team”.

But again, another comment was that they considered the network had “gone against the grain of the general industry a bit on this project. There seems to have been a real desire to deliver, with very few of the team working for themselves or with agendas to work towards. Egos seem to have been left at the door up to now. Some high levels of trust and wanting to work collaboratively.”

It seems evident it may depend on your position within the network or your proclivity towards trusting that sets the view of the disparity and its effects. And this seems to be supported by the statement *“there was instances of some argumentative language in communications about [site issues]. This displays a level of trust/distrust where others had a differing view of that trust relationship.”* If you are not party to the language and displays of distrust, you may have a different view of the network’s effectiveness in this regard.

Q3.3 - Specifically for this project, to what level do you think any disparity in trust levels affected the outcomes of the Project Delivery?

Refer to Case Study 1.

In addition;

Reflecting Q3.2, one respondent stated that *“any disparity hasn’t been evident, and I think we have been quite successful in delivering”*. This was not a common view. It was commented that there didn’t appear to be a disparity in relationships prior to contract execution, but that there were variations afterwards in specific instances with some trust degradation between some. This then had an affect on the wider network; *“The relationships degradation meant that walls went up and communications got less effective. There was plainly an imbalance of trust in what we was being conveyed and how it was being received. Once the lack of trust was out in the open it became clear that*

the position was problematic, but the levels of trust perception were probably then equalised.”

The nature of “expectation” was discussed by one actor along with how this may prove to have a more pronounced impact on imbalance; *“Potentially those who come with higher levels of trust initially, when they get into the detail of the project and find there are aspects that are incomplete, their trust is then eroded at a higher volume than those who came with less initial trust (even distrust). Does this then have a more problematic impact on their approach to the project more widely? With a knock on effect of degrading the positivity towards the project and their role in it.”* It highlights the nature of the “person” involved in a project, their preconceptions and how they may be psychologically affected by a loss of or disparity in reciprocal trust.

4. Client definition of objectives

Q4.1 - In general, what is your view on how the Client defining their key value objectives affects performance delivery?

Refer to Case Study 1.

In addition; The further respondents agreed entirely with the rest of the network in the critical nature of Clients’ providing a strong brief and how *“providing the value objectives is key to getting the job done. The impact of not understanding the brief will be significant without good communication.”*

It was said that it is not always the case that Contractors get the “full picture” in this regard and that *“there are always nuances in regards the Client’s objectives. It is important to define these correctly for the benefit of all parties”* particularly when their experience can have a significant impact; *“Some values are very similar across many projects.”*

Q4.2 - For this project, what were the Client's value objectives and how were they defined?

Refer to Case Study 1.

In addition; the additional respondents were largely aligned with the majority of the other network members in that they believed these hadn't been clearly defined or communicated well, noting that it had been "*defined largely by word of mouth, there was no written brief.*"

That "*they wanted a bit of a high degree of time, cost and quality and how these interlinked was not clear*" caused issues even leading to having an impact on wider community communications (a key issue on this project due to the location).

One actor noted the existence of the "Project Charter" and the key requirements of "*Collaborative working, Quality of finish, safe environment, learning experiences and employment opportunities*". No mention of programme or cost which had plainly been the focus for others at key times.

Q4.3 - Specifically for this project, what is your view on how the Client's communication of value objectives have affected the team delivery?

Refer to Case Study 1.

In addition; the additional respondents were largely in agreement in that the poor communication of objectives had had a negative impact on the project delivery. "*Poor communication has probably affected how we've been able to deliver. Changes in requirements , poorly communicated, will always have that effect*" and "*the manner of communication has made delivery harder*". But in relation to how the Project Charter and how the Contractor has been able to deliver to this, there is a different viewpoint, "*those things in the charter are what we do as a company anyway. They match our own values. Ties up with our own business objectives.*" As noted in Q4.2, the charter does not allude to Cost or Programme.

Q4.4 - Specifically for this project, how do you think the manner of Client's communication of value objectives has impacted on the approach to collaboration between the delivery team?

Refer to Case Study 1.

In addition; the respondents commented that the inherent lack of control due to the poorly communicated brief has made collaboration across the network more difficult, as people have differing views of requirement priority.

"Due to the lack of clarity the project was put under a degree of pressure, which leads to reactive management. This makes collaboration harder and causes tension" and, "Clear and honest communication is always the best policy, and not doing it in this way has had a massive impact".

5. Collaboration and Building Services

Q5.1 - In general, what is your view on how collaborative procurement of building services affects project outcomes when measured against "Client defined value requirements"?

Refer to Case Study 1.

In addition; the respondents all agreed that as early as possible collaboration with the supply chain should be of benefit in most project settings. One actor expressed the following view *"it seems to me that building services designers create incomplete designs and then pass them to the contractor to finish off and that means coordination isn't completed. Early collaboration should improve that situation."*

Two of the respondents commented on the *"Black Art"* of MEP and that the *"supply chain have an awful lot of knowledge on this significant aspect of any project and having them engaged at the right time will always have a beneficial impact on a project."* The benefit of doing this before the contract is signed, ironing out any issues in the design and delivery model should provide project benefits.

Q5.2 - Specifically for this project, how would you describe the approach to collaborative early engagement with the Building Services supply chain?

Refer to Case Study 1.

In addition; again, some respondents were either not aware or not involved in the engagement. Those that were commented *“the engagement with the supply chain really worked. We were in much better position before the contract was signed than we normally would have been. So it has had a benefit.”*

Q5.3 - Specifically for this project, what effect did the approach to collaborative early engagement with the Building Services supply chain on delivering to Client defined value requirements?

Refer to Case Study 1.

No further comments provided by either those who were not involved in the early engagement or those that were (referred to Q5.2).

Q5.4 - Specifically for this project, in what way was the collaborative approach taken towards the Building Services Supply Chain effective?

Refer to Case Study 1.

In addition; One actor simply confirmed that *“it has been effective”*. Another stated that what happened *“has helped with early cost certainty, value engineering and the relationship with the design team. That has helped the process. The modular approach has been an innovation that we might not have got going a normal, traditional, route, and this will benefit this project, especially around the logistics of the site etc.”* It is commented here that the modular approach to the Building Services, an innovation in itself, is not widely known about by the whole network.

6. Collaborative Procurement Approach Effect

Q6.1 - In comparison to the pilot case study (SJPS) Project (or others if not involved in SJPS), in what way did the alternative procurement approach taken affect this project?

Refer to Case Study 1.

In addition; the further respondents had some clear views on how the approach taken impacted on outcome and mostly in a positive sense, but some were also dismissive of some aspects; *“Do I think the contractor has provided more resolutions to problems? I think there's a mixed bag here. I think whilst they have raised issues and resolutions, they have also raised issues with no resolution.”*

Another noted that whilst it had probably been of benefit, they ruefully said *“its probably a slight improvement but with a bit more effort could be further improved. If some parties' attitudes were better towards collaboration, we could have done this better.”* And another looked at this in the broader sense in comparing to a traditionally procured approach; *“The process of pricing what is only in the tender documents and being able to drive a bus through the gaps post contract does not develop any level of trust, in fact it probably induces mistrust. It's the common thread in the industry and therefore trust is hard to find in that regards.”*

Q6.2 - How did the collaborative procurement approach advocated affect trust between project participants?

Refer to Case Study 1.

In addition; there was a common view that there had been a mixed outcome and that the approach could have, should have, provided better outcomes. One actor noted the influence it had on trust; *“I think what we did has increased the trust levels between all parties and I think the face to face discussions have assisted that. Could we have done it better? Earlier workshopping might have helped.”*

Another actor reflected on the nature of the individual and personality influence on the approach taken; *“It had a mixed affect and that came down to*

attitudes towards the engagement and the perception of their authority etc. Some personalities have been almost disruptive through the collaboration."

One actor was particularly positive on what was undertaken, *"It's the exact opposite of the traditional, problematic, approach, and it certainly affected the trust in a positive way. The "open-book" procurement approach promoted trust and a reliance on one another for a common goal."* It is noted that the commercial relationships have largely remained positive and strong even under significant pressure.

Q6.3 - How did the collaborative procurement approach advocated affect delivery to "Client defined value requirements"?

Refer to Case Study 1.

In addition; There was a common view that whilst intentions were good, it could have been done better, which would have meant positive outcomes would have been more likely. One positive noted was that there had *"been more transparent discussions which sometimes you do not get when problems occur on projects."* One actor noted that they believed that the Client definition of their requirements had had an impact on how the procurement approach was able to benefit the project; *"I do think if the Client objectives had been clear for all parties the collaboration would have worked even better."*

General Comments provided by respondents

The opportunity was afforded to those interviewed to provide general comments on the subject matter. This comment reflects the impact that the actions of individuals within a network can have in regards trust; *"There were some instances of one-upmanship within the team and that certainly was detrimental to the whole trust ethos within the project team. That has a real negative reaction by others within the team and causes trust degradation. If one party comes out of the "trust bubble" it has a profound effect and can burst the bubble completely."*

D.3.4 Section 2 - The Network structure

The structure of the network being studied is expressed graphically and, in relation to key Social Network Analysis indicators, in numeric form. The two aspects considered are the *Network density* (a comparison of potential nodal links to that enacted within the network), and the *centrality* of the individual actors and as a collective.

The two key time frames of the study are represented (the 3 months prior to contract execution and the 3 months immediately following) and comparisons drawn.

Three months prior to Contract execution

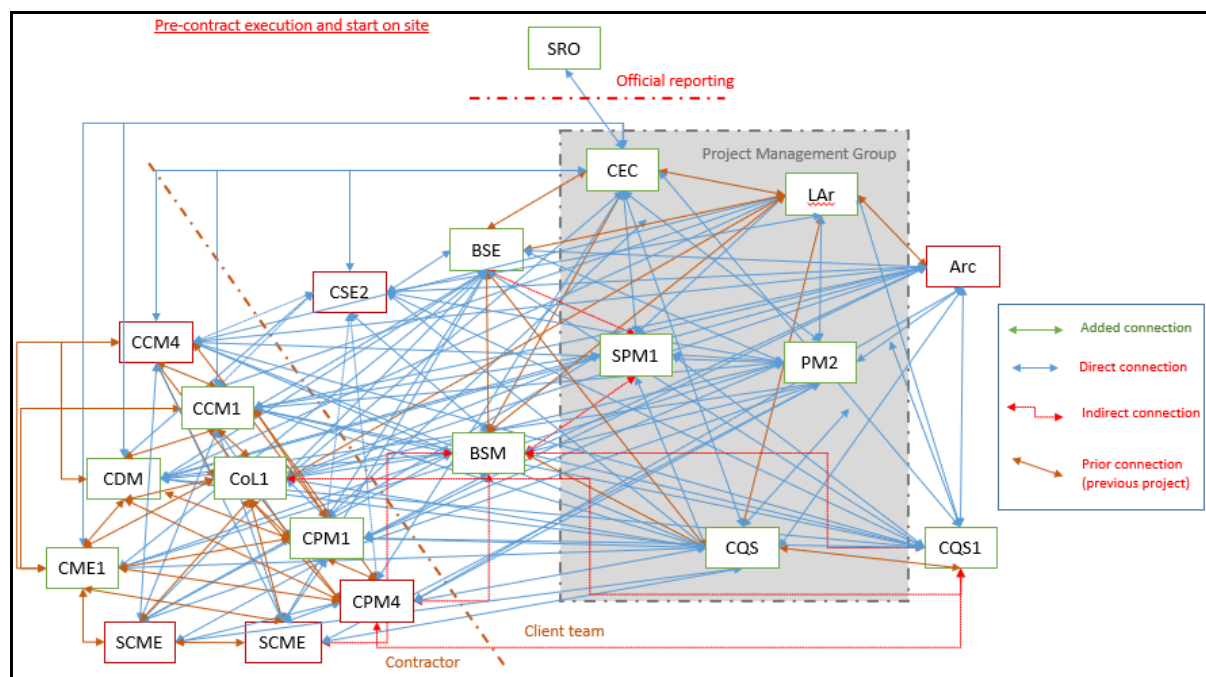


Figure D.3.1: SNA diagram – CLPS, Pre-contract

Figure D.3.1 shows a quite well interconnected network with a number of connections that were already existing (previous projects and the like). The *busy-ness* of the network reflects how there was a high degree of interaction at this stage, including a number of connections that are noted as being via another actor. The Project Management Group (PMG) members are situated

in the grey shaded area, with *some* of the actors being the same from Case Study 0.

Network density

Number of nodes	19
Total Number of potential links	171
Number of links present	130
Network density	0.760

The network density shown here indicates a density of 76% (marginally lower than Case Study 2). This reflects the interactional nature of the pre-contract obligations of the Stage 1 collaborative engagement and the *busy-ness* of the network. That it is not higher reflects a number of the network believing they were distant from some other members. Looking at the data behind this the significant areas of lack of connectivity are between the Contractor and Sub-Contractor MEP representatives (CME1, SCME) and the members of the Client team not directly involved in MEP design (as for both case studies 1 and 2)

Centrality

Each actor's centrality score is noted along with a graded scale (green indicating high, red indicating low). A spread of those actors with the highest centrality, from both Client and Contractor's teams. The most significant are CPM1 and CCM1 who were driving the Contractor's engagement with the team, followed by CQS (leading commercially) and then a number of others such as CDM and CEC. Reflecting comment above on the Network Density, CME1, CPM4 (largely not involved with the client team at this stage), SCME score the lowest (understandably) along with SPM1. This

Client	CEC	0.861
	SPM1	0.583
	PM2	0.889
	LAr	0.722
	Arc1	0.806
	CSE2	0.722
	BSM	0.833
	BSE	0.833
	CQS	0.917
	CQS1	0.722
Contractor	CoL1	0.861
	CPM1	1.000
	CPM4	0.583
	CCM1	1.000
	CCM4	0.833
	CDM	0.917
	CME1	0.639
	SCME	0.583
	SCME	0.528
Average centrality		0.781
Client Average		0.789
Contractor average		0.772

may indicate that whilst PM2 was leading the Project management aspects, the Senior PM representative was seen as distant or not as central to the network interactions. The relatively high centrality of the overall network and the balance between Client and Contractor average centralities should represent an active network with good communication lines.

Whilst centrality is generally referred to for individual actors within a network, the averages are included here for comparison to the second timeframe.

Three months following Contract execution

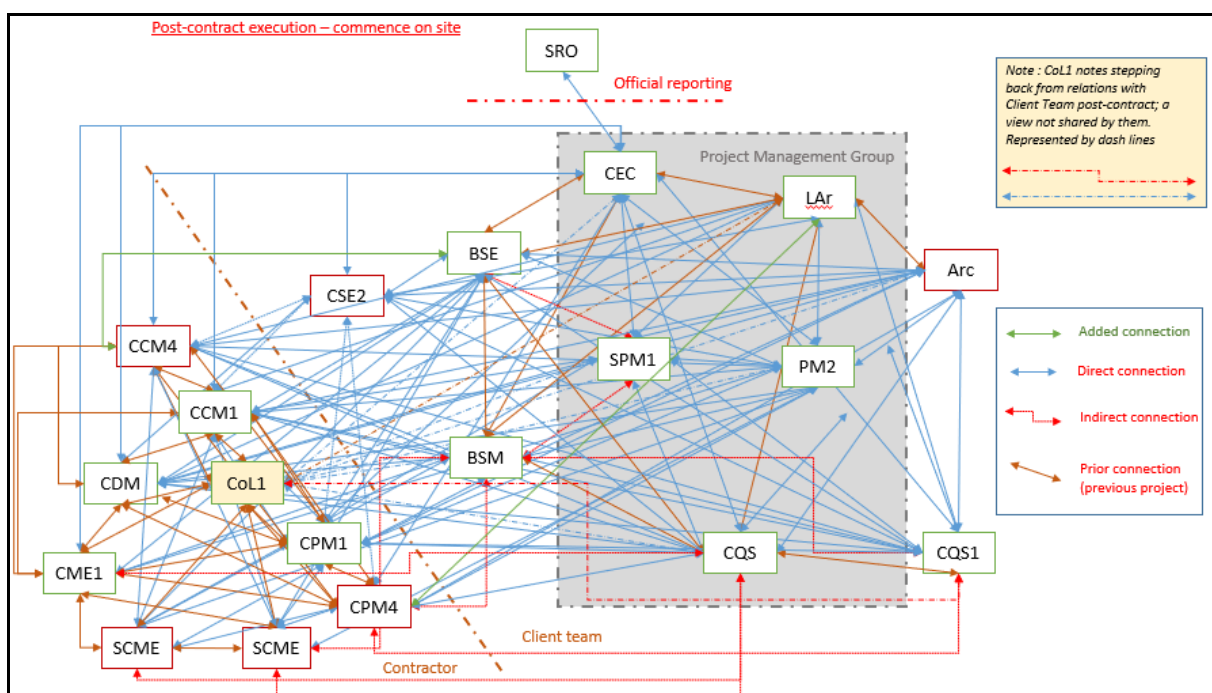


Figure D.3.2: SNA diagram – CLPS, Post-contract

Figure D.3.2 is in the same format as the pre-contract version but then reflects the changes noted from the network responses. The most notable is that CoL1 noted that he believed he stepped away from the network (from the Client side at least) once the Contract was executed. Whilst this might have been his perception, Client actors in the network still considered him being involved. Another item of note is that the direct link between the Client commercial actors and the MEP Subcontractors was diminished, being via others.

Network density

Number of nodes	19
Total Number of potential links	171
Number of links present	113
Network density	0.661

The network density shown here indicates a density of just over 66% (lower than Case Study 2), a more significant reduction from the pre-contract period observed. This is reflective of the comment from CoL1 (reduction in present links) and the link degradation of the MEP subcontractors, but also of other members of the network who noted a number of “disconnections”, some of which might be considered significant (links to CPM4, delivery PM, for example).

Centrality

Client	CEC	0.833
	SPM1	0.611
	PM2	0.889
	LAr	0.694
	Arc1	0.806
	CSE2	0.528
	BSM	0.778
	BSE	0.833
	CQS	0.861
	CQS1	0.722
Contractor	CoL1	0.611
	CPM1	1.000
	CPM4	0.833
	CCM1	0.972
	CCM4	0.944
	CDM	0.861
	CME1	0.667
	SCME	0.500
	SCME	0.500
	Average centrality	0.760
	Client Average	0.756
	Contractor average	0.765

The two most central actors in the network changed to being CPM1 (as before) and CCM1. CCM 4 is a close third. This reflects the slightly more prominent position of the project specific project and commercial management, but CCM4 (Contractor’s Project PM) does not appear to have key centrality at this stage (as noted above in network density). Generally though the Contractor element take a more central role, along with PM2, as delivery gets underway. This is as should be anticipated. CSE2 scores quite lowly which at this stage of the project might be seen as unusual given the nature of the works immediately after contract execution (civils and structural). There is a sense (from these figures and interview comments) that CSE2 was somewhat *distant* from the network. The slight general downward trend of the centrality scores remains a factor of CoL1 being less positive towards his position in the network as others view,

but it is also may reflect a degradation of some relationships and the approach to the collaboration. Arguably however, centrality should have, at least, remained the same, as in the period post contract execution there should have been a similar level of collaboration to ensure the project progressed. The slight reduction in scores could also be reflective of the more traditional approach that ensued once the (traditional) contract was enacted. In regards leadership, the two senior leadership actors (SPM1 and CoL1) score relatively lowly; could this be a factor in the effectiveness of the network in continued collaboration?

Network Density and Centrality

The two measures of a networks connectivity and activity are summarised here for the two periods considered.

	Network Density	Centrality
3 Months prior to Contract	0.760	0.781
3 Months after Contract	0.661	0.760

Comparative comments

The change between the two timeframes, it could be argued, *should* not have happened given the collaborative approach was advocated to be undertaken throughout the entire project. The reality is that the both the density and the centrality are affected by the relative positioning in three key areas;

CoL1 and their “stepping back” from the network

The network locations and connectivity of CSE2 and CPM4, arguably both key actors in the second timeframe. Their connectivity impacts in a number of ways.

SCME and their direct connectivity with the Client commercial network members.

The scoring still represents a reasonably active and communicative network; the question is then around its effectiveness. This will be addressed by the responses from other aspects of the SNA questions.

Scored responses to SNA questions

It should be noted that, unlike Case Study 0, the two MEP sub-contract members of the network (SCME) are included within this element of the study as they were present throughout the period of research.

In regards the outline of questions posed, scoring methodology and outline analysis and comparison; this remains the same for all case studies and can be found in this section of Case Study 0. It is not repeated here.

D.3.5 Relative Importance Index

RII general outcomes

The data is summarised in table D.3.2 and figure D.3.3 to show the average RII response to the SNA questions for both Pre-Contract and Post-Contract periods. The shift in RII is then indicated to express if the actor had a more positive or negative view between the two periods.

	Average RII response		movement	
	Pre-Contract	Post Contract		
CEC	0.60	0.62	0.02	same or more positive
SPM1	0.69	0.67	-0.02	less positive
PM2	0.68	0.72	0.03	same or more positive
LAr	0.71	0.57	-0.14	less positive
Arc	0.72	0.68	-0.04	less positive
CSE2	0.66	0.65	-0.01	less positive
BSM	0.77	0.77	0.00	same or more positive
BSE	0.65	0.71	0.06	same or more positive
CQS	0.82	0.75	-0.08	less positive
CQS1	0.70	0.65	-0.04	less positive
CoL1	0.77	0.77	0.00	less positive
CPM1	0.90	0.90	0.00	same or more positive
CPM4	0.58	0.60	0.02	same or more positive
CCM1	0.87	0.89	0.01	same or more positive
CCM4	0.86	0.81	-0.05	less positive
CDM	0.74	0.70	-0.05	less positive
CME1	0.73	0.73	0.00	less positive
SCME	0.85	0.82	-0.03	less positive
SCME	0.85	0.82	-0.03	less positive
Average	0.75	0.73	-0.02	less positive

Table D.3.2 : Overall RII responses

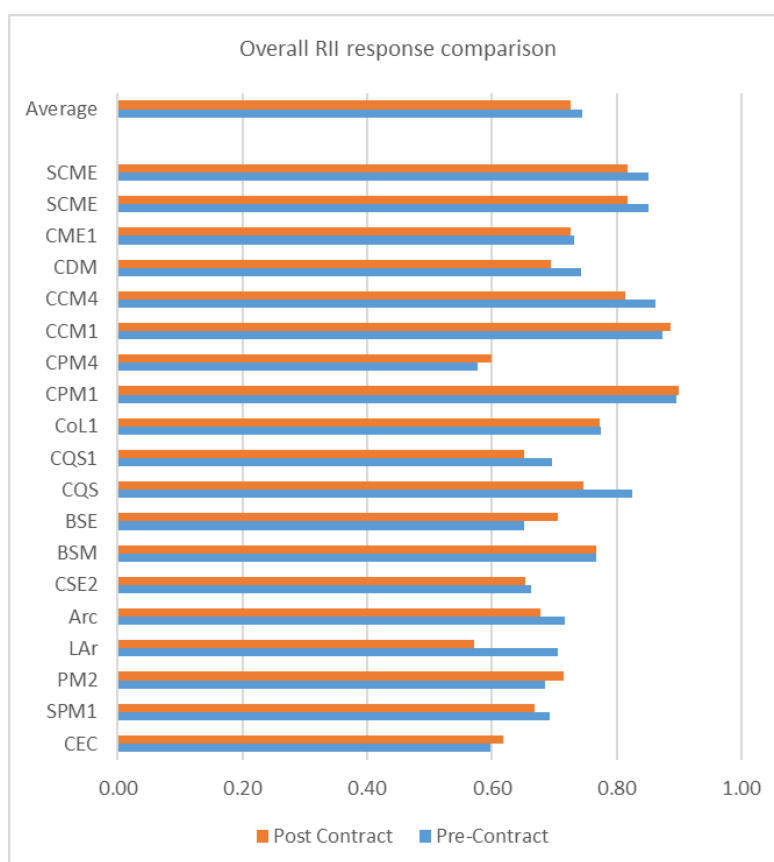


Figure D.3.3 : Overall RII response comparison

This indicates that the overall view was less positive following contract execution, albeit marginally. There are however some notable observations. Again CoL1's response is more than likely slanted due to his view of who he is scoring in the post-contract period (largely those from his own organisation). There are a variety of movements in positivity, and it is not necessarily along the lines of client/contractor. Notably, CEC, PM2, CPM1 and CCM1 (ostensibly the delivery leadership) all indicate more positivity towards the network. This may suggest that they consider the delivery phase to be more beneficial than the engagement phase. BSE and BSM are also more positive towards the network (particularly BSE) which may infer that they believe the delivery phase may be more effective. Conversely SCME has a less a positive view of the network which may be a factor of their *imposed* distance or that they are generally not as positive following the early engagement phase. This is similar (not the same movements) to the response from Case Study 2 (BPS) and Case Study 3 (VPS). Does this represent less surety following the positive engagement interaction from the Subcontractors as they move into delivery? And does this also represent more confidence in this Subcontractor from the relevant Designers? Does this divergency cause an issue? Does it represent an imbalance in the levels of trust in one another for example?

RII data distributions

Table D.3.3 show that, using the RII measure, the data is a mixture between "normal" and "*not normal*" distributions, and this is reflected in the individual data analysis that follows. This does not represent an issue but has to be recognised in the data analysis. It is a factor of the data being collected from actors who express *very personal* views within the context of the SNA questions, and particularly in certain question areas. The only question that elicit a "normal" distribution both pre- and post-contract, through this measure, is in regards how each actor views Trust. This then suggests a more balanced view of the network, from the actors; it may reflect equally levels of trust (or

lack of). Collaboration is split from a not-normal distribution pre-contract to a normal distribution post-contract. This might reflect the difference in opinion in how the two periods compare from different actor's points of view. This will be further narrated in the individual response to follow.

		within 1 SD	average range from SD	distribution
TRUST	Pre-contract	68%	0.83	normal
TRUST	Post-contract	68%	0.80	normal
COLLABORATION	Pre-contract	63%	0.84	not normal
COLLABORATION	Post-contract	79%	0.78	normal
TRANSFER OF KNOWLEDGE TO ACTOR	Pre-contract	58%	0.90	not normal
TRANSFER OF KNOWLEDGE TO ACTOR	Post-contract	58%	0.87	not normal
TRANSFER OF KNOWLEDGE FROM ACTOR	Pre-contract	58%	0.83	not normal
TRANSFER OF KNOWLEDGE FROM ACTOR	Post-contract	68%	0.83	normal
PROFESSIONAL RELATIONSHIP	Pre-contract	53%	0.87	not normal
PROFESSIONAL RELATIONSHIP	Post-contract	47%	0.88	not normal

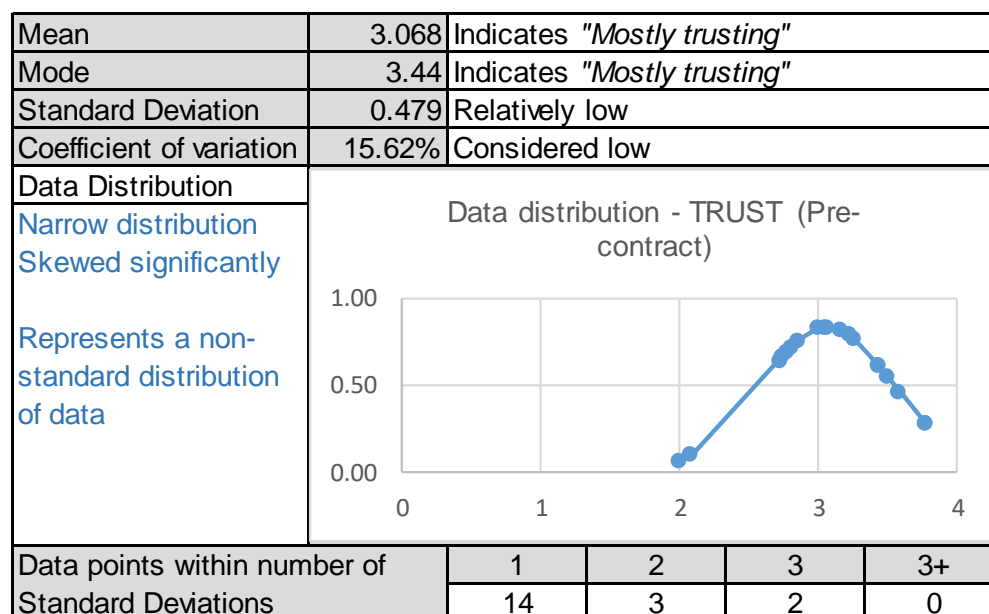
Table D.3.3 : RII data distributions

D.3.6 SNA Questions outcomes

What degree of trust do you have in each actor?

Three months prior to Contract execution

TRUST (PRE): Individual scores response : *Figure D.3.6.1*



TRUST (PRE): Individual reciprocal scores response : *Table D.3.6.1*

	Average Score	Average difference	Average magnitude	Difference	Magnitude
CEC	2.00	-1.22	1.33	Less trust displayed	Significant difference
SPM1	2.77	-0.72	1.50	Less trust displayed	Significant difference
PM2	2.72	-0.06	0.39	Less trust displayed	Minimal difference
LAr	3.07	-0.22	0.89	Less trust displayed	Mid-range difference
Arc1	2.80	-0.50	1.17	Less trust displayed	Significant difference
CSE2	2.75	-1.39	1.50	Less trust displayed	Significant difference
BSM	3.06	0.11	1.00	More trust displayed	Mid-range difference
BSE	3.27	-0.33	1.00	Less trust displayed	Mid-range difference
CQS	3.59	-0.39	0.50	Less trust displayed	Minimal difference
CQS1	2.86	-1.33	1.33	Less trust displayed	Significant difference
CoL1	3.22	0.56	0.89	More trust displayed	Mid-range difference
CPM1	3.78	0.72	0.72	More trust displayed	Mid-range difference
CPM4	2.08	-0.83	1.39	Less trust displayed	Significant difference
CCM1	3.78	0.72	0.72	More trust displayed	Mid-range difference
CCM4	3.17	0.56	0.89	More trust displayed	Mid-range difference
CDM	3.00	-0.17	0.61	Less trust displayed	Mid-range difference
CME1	3.50	1.11	1.44	More trust displayed	Significant difference
SCME	3.44	1.67	1.61	More trust displayed	Significant difference
SCME	3.44	1.83	1.61	More trust displayed	Significant difference

Observations

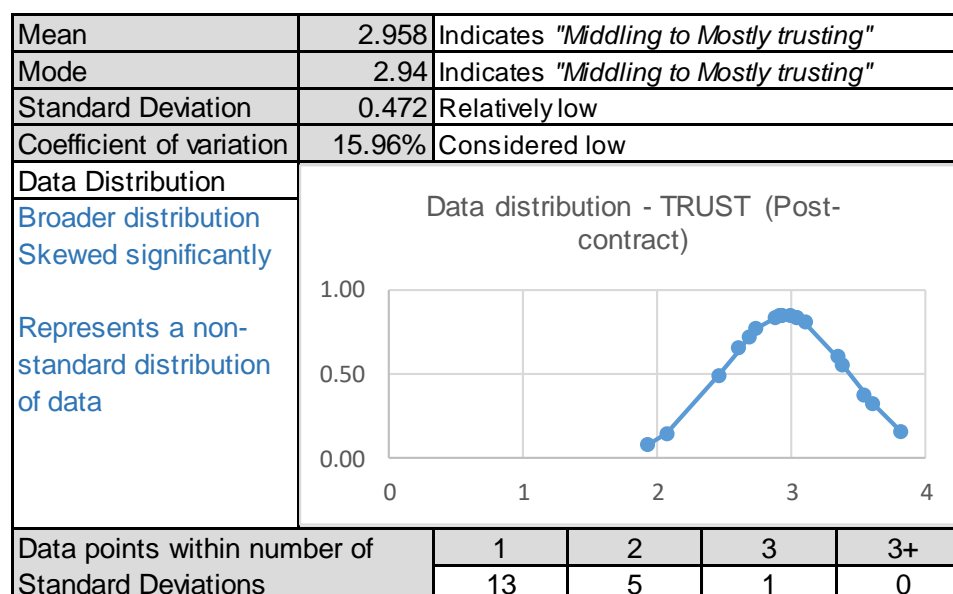
The out turn is that the respondents *mostly trusted* the network, albeit there are a number of factors in this; CEC scored significantly lower than the rest of the network whilst CPM1, CQS, SCME and CME1 scored relatively very much higher. CEC's scoring may be reflective of their overall view of the network (as was expressed through interview) and the higher scoring noted could be an indication of the view of the early engagement with the MEP supply chain. The view of the network (however limited) of trusting one another was not reciprocated entirely, with some of those noted above having a significantly higher view of trust within the network than was reciprocated. This impacts the *co-efficient of variation* but is somewhat tempered by some closely reciprocated views between other network members.

CME1, SPM1 and CEC indicate significant differences in their view of other within the network, and this is considered to be due to their perceived connections (CME1 and SPM1) and general negative view of the project network from CEC. CSE2's difference in view reflects some of his comments on, and scoring of, his position within the network (as previously noted).

What degree of trust do you have in each actor?

Three months following Contract execution

TRUST (POST): Individual scores response : *Figure D.3.6.2*



TRUST (POST): Individual reciprocal scores response : *Table D.3.6.1*

	Average Score	Average difference	Average magnitude	Difference	Magnitude
CEC	1.94	-1.00	1.22	Less trust displayed	Significant difference
SPM1	2.62	-0.44	1.56	Less trust displayed	Significant difference
PM2	2.89	0.50	0.83	More trust displayed	Mid-range difference
LAr	2.92	-0.22	1.00	Less trust displayed	Mid-range difference
Arc1	2.47	-0.50	1.06	Less trust displayed	Significant difference
CSE2	2.75	-0.94	1.06	Less trust displayed	Significant difference
BSM	3.06	0.39	1.06	More trust displayed	Significant difference
BSE	3.06	0.17	0.94	More trust displayed	Mid-range difference
CQS	3.35	-0.28	0.50	Less trust displayed	Minimal difference
CQS1	2.69	-0.89	1.22	Less trust displayed	Significant difference
CoL1	3.83	-1.22	1.33	Less trust displayed	Significant difference
CPM1	3.61	0.61	0.72	More trust displayed	Mid-range difference
CPM4	2.08	-1.33	1.33	Less trust displayed	Significant difference
CCM1	3.56	0.72	0.83	More trust displayed	Mid-range difference
CCM4	3.11	0.61	0.83	More trust displayed	Mid-range difference
CDM	3.00	-0.17	0.61	Less trust displayed	Mid-range difference
CME1	3.39	1.11	1.33	More trust displayed	Significant difference
SCME	2.94	1.44	1.17	More trust displayed	Significant difference
SCME	2.94	1.44	1.17	More trust displayed	Significant difference

Observations

The network generally is “mostly trusting” with some individual exceptions; CEC remains as the lowest scoring and displays less trust in others reciprocated view, and CPM4 also scores quite low. This indicates that he does not tend to trust those involved in the post contract stage (with more of his involvement with the client-side team), and this view is not reciprocated (potentially indicating an imbalance in trust levels). SPM1 and CoL1 display the highest average magnitude differences, and this reflects their relative positions in regards “distance”. SCME, the MEP subcontractor, comes more in line with the rest of the network, but this represents a less positive view of trust in the network actors as they moved into the delivery phase. However, those enacting the leadership of the project still have positive views of trust, by and large.

Comparative observations

The movement of key measures from the data between the two time frames could indicate general trend, in the following way;

Mode	-0.50
Coefficient of variation	0.34%
Average score	-0.110
Average difference	-0.006
Average magnitude	-0.038

- *Mode decreasing*; slightly lower trust scoring
- *Coefficient of variation*; a slightly increased difference in degree of trust
- *Average score*; generally reduced levels of trust
- *Average difference*; marginally reduced
- *Average magnitude*; decrease in the variation of difference between reciprocal scoring, more reciprocally balanced trust

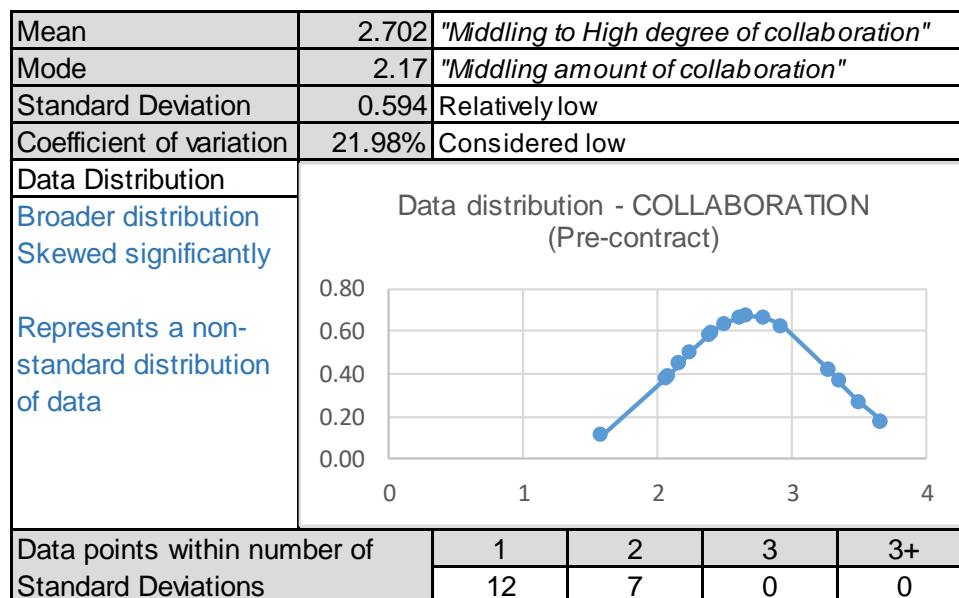
The marginal decrease in the Mode (and slight decrease in Mean) indicates a lesser degree of trust within the network between the two time periods. Plainly there will be individuals who would not have the same view. However, the network shows that it is more balanced in the view of trust as differences and

magnitudes both reduce, so reciprocated views are likely to be closer. A lesser difference in the views of how actors trust one another is potentially a positive. Does this mean the collaborative approach HAS had a positive impact on the network in this instance; it is almost counter intuitive – they trust each other less, but they tend to agree with the ratings more!

What degree of collaboration is there with each actor?

Three months prior to Contract execution

COLLABORATION (PRE): Individual scores response : *Figure D.3.6.3*



COLLABORATION (PRE): Individual reciprocal scores response : *Table D.3.6.3*

	Average Score	Average difference	Average magnitude	Difference	Magnitude
CEC	2.06	-0.67	1.00	Less collaborative	Mid-range difference
SPM1	2.92	-0.11	1.22	Less collaborative	Significant difference
PM2	2.17	-0.50	0.61	Less collaborative	Mid-range difference
LAr	2.79	-0.17	0.94	Less collaborative	Mid-range difference
Arc1	2.67	-0.61	1.06	Less collaborative	Significant difference
CSE2	2.08	-1.72	1.72	Less collaborative	Significant difference
BSM	2.39	-0.22	1.00	Less collaborative	Mid-range difference
BSE	2.40	-0.83	1.17	Less collaborative	Significant difference
CQS	3.35	-0.17	0.72	Less collaborative	Mid-range difference
CQS1	2.50	-0.94	1.06	Less collaborative	Significant difference
CoL1	2.61	0.17	1.17	More collaborative	Significant difference
CPM1	3.67	1.06	1.39	More collaborative	Significant difference
CPM4	1.58	-0.89	1.11	Less collaborative	Significant difference
CCM1	3.67	1.00	1.33	More collaborative	Significant difference
CCM4	3.50	1.33	1.56	More collaborative	Significant difference
CDM	2.25	-0.89	1.00	Less collaborative	Mid-range difference
CME1	2.17	0.28	0.94	More collaborative	Mid-range difference
SCME	3.28	2.00	1.56	More collaborative	Significant difference
SCME	3.28	2.00	1.56	More collaborative	Significant difference

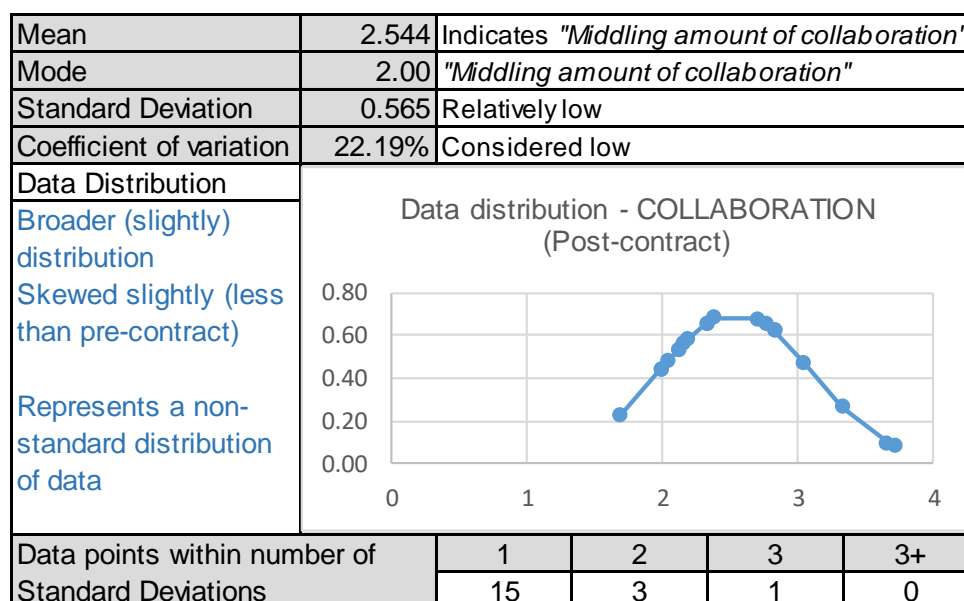
Observations

Whilst it is observed that the Mean Score indicates “Middling degree of collaboration”, it is noted that this is erring towards the “High Degree” but is impacted by a number of lower scorers. The Contractor team tend to be more positive around the scoring of collaboration (and this might be due to some limitations of their team in connectivity to Client members), whereas the Client side team are not as vociferous in this regard. Whilst SCME scored the level of collaboration higher than most others considered both BSM and BSE scored the level lower, which perhaps indicates either that the Subcontractor the collaboration was more effective or that the collaboration that BSM and BSE had with others was not as rewarding as that with the MEP supply chain. CSE2 scores significantly lower than most of the rest of the network’s view of collaboration with them; again, this reflects what they indicated during interview.

What degree of collaboration is there with each actor?

Three months following Contract execution

COLLABORATION (POST): Individual scores response : *Figure D.3.6.4*



COLLABORATION (POST): Individual reciprocal scores response : *Table D.3.6.4*

	Average Score	Average difference	Average magnitude	Difference	Magnitude
CEC	2.13	-0.28	0.72	Less collaborative	Mid-range difference
SPM1	2.77	0.33	1.00	More collaborative	Mid-range difference
PM2	2.33	0.06	0.50	More collaborative	Minimal difference
LAr	1.69	-0.50	0.72	Less collaborative	Mid-range difference
Arc1	2.20	-0.44	0.78	Less collaborative	Mid-range difference
CSE2	2.33	-1.11	1.33	Less collaborative	Significant difference
BSM	2.39	0.56	1.11	More collaborative	Significant difference
BSE	2.06	-0.39	0.72	Less collaborative	Mid-range difference
CQS	2.71	-0.11	0.56	Less collaborative	Mid-range difference
CQS1	2.00	-0.67	0.89	Less collaborative	Mid-range difference
CoL1	3.33	-0.83	1.17	Less collaborative	Significant difference
CPM1	3.72	1.11	1.22	More collaborative	Significant difference
CPM4	2.00	-0.94	0.94	Less collaborative	Mid-range difference
CCM1	3.67	1.33	1.33	More collaborative	Significant difference
CCM4	3.06	0.83	0.94	More collaborative	Mid-range difference
CDM	2.13	-0.78	0.89	Less collaborative	Mid-range difference
CME1	2.17	0.39	1.06	More collaborative	Significant difference
SCME	2.83	1.56	1.28	More collaborative	Significant difference
SCME	2.83	1.56	1.28	More collaborative	Significant difference

Observations

Whilst the number of data points within 1 SD increased, indicating a closer correlation between respondents, 1 data point is only within 1 SD. So a degree of the view of collaboration being more common between the actors, aside from the *errant* data point. Plainly there are some differences in the view of individuals. The two actors with the highest “difference” are CCM1 and CSE2, but with different data outcomes. CCM1 sees more collaboration in the network (compared to other actors) (as does CPM1), whilst CSE2 believes that he is less involved in collaboration (compared to other actors). SCME indicate a significantly different view than the rest of the network, indicating they believe there to be more collaboration than others consider.

Comparative observations

The movement of key measures from the data between the two time frames could indicate general trend, in the following way;

Mode	-0.17
Coefficient of variation	0.21%
Average score	-0.157
Average difference	0.082
Average magnitude	-0.193

- *Mode decreasing*; slightly lower collaboration scoring
- *Coefficient of variation*; an increased difference in degree of the view of collaboration
- *Average score*; marginally reduced levels of collaboration
- *Average difference*; slightly higher reciprocal scoring.
- *Average magnitude*; reduction in the variation of difference between reciprocal scoring, more reciprocally balanced view of collaboration action.

The network seems to have a less balanced view of how it is collaborating given that the average score reduced very slightly (but this can be affected by a number of individual scores); an increase in the coefficient of variation, lower reciprocal scoring, and higher average magnitude show that the

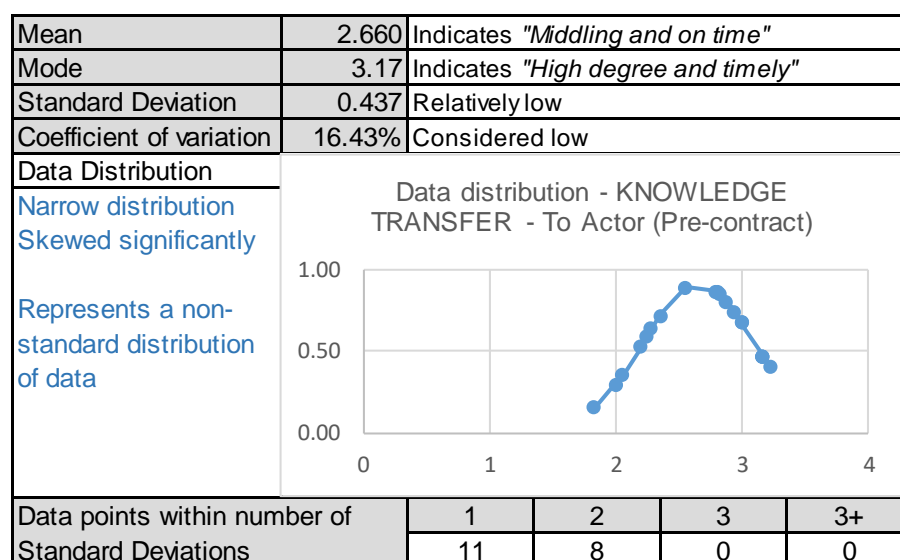
network has a less common view, but this does not necessarily mean that they believe they are all collaborating to a lesser degree (small changes).

What degree of Transfer of Knowledge is there with each actor - **To actor?**

Three months prior to Contract execution

KNOWLEDGE TRANSFER TO ACTOR (PRE): Individual scores response :

Figure D.3.6.5



KNOWLEDGE TRANSFER TO ACTOR (PRE): Individual reciprocal scores response : *Table D.3.6.5*

	Average Score	Average difference	Average magnitude	Difference	Magnitude
CEC	2.00	-1.00	1.11	Less KT TO Actor	Significant difference
SPM1	3.00	-0.22	1.00	Less KT TO Actor	Mid-range difference
PM2	2.56	-0.28	0.50	Less KT TO Actor	Minimal difference
LAr	2.36	-0.67	1.00	Less KT TO Actor	Mid-range difference
Arc1	2.80	-0.44	1.00	Less KT TO Actor	Mid-range difference
CSE2	2.25	-1.17	1.39	Less KT TO Actor	Significant difference
BSM	2.94	0.39	0.83	More KT TO Actor	Mid-range difference
BSE	2.20	-0.94	1.17	Less KT TO Actor	Significant difference
CQS	2.88	-0.33	0.78	Less KT TO Actor	Mid-range difference
CQS1	2.29	-1.22	1.44	Less KT TO Actor	Significant difference
CoL1	2.83	0.56	0.89	More KT TO Actor	Mid-range difference
CPM1	3.17	0.78	1.11	More KT TO Actor	Significant difference
CPM4	1.83	-0.78	1.00	Less KT TO Actor	Mid-range difference
CCM1	3.00	0.44	0.89	More KT TO Actor	Mid-range difference
CCM4	3.22	0.83	1.06	More KT TO Actor	Significant difference
CDM	2.81	0.28	0.83	More KT TO Actor	Mid-range difference
CME1	2.06	0.17	1.17	More KT TO Actor	Significant difference
SCME	3.17	1.94	1.56	More KT TO Actor	Significant difference
SCME	3.17	1.94	1.56	More KT TO Actor	Significant difference

Observations

The requirements of a procurement approach such as was undertaken here would lend themselves to a necessity for a high degree of Knowledge Transfer; the 2 stage approach positively involves it. But the scoring from the network intimates that the transfer of knowledge TO other actors was merely “middling” (albeit it is a high degree using Mode as a measure), but at least it was “on time”. There is a, more or less, definitive split between the Client and Contractor teams within the network; with the Client actors nominally stating that there was less transfer TO other actors, with the Contractor actors being the reciprocal of that. As a collaborative process with design reviews and market testing (alongside the MEP collaborative workshops) being undertaken in this period, this *should* be the case as a high degree of information should be transferring from Contractor TO Client. SCME’s view that they were transferring a high degree of information to others is not necessarily reciprocated by the rest of the wider network.

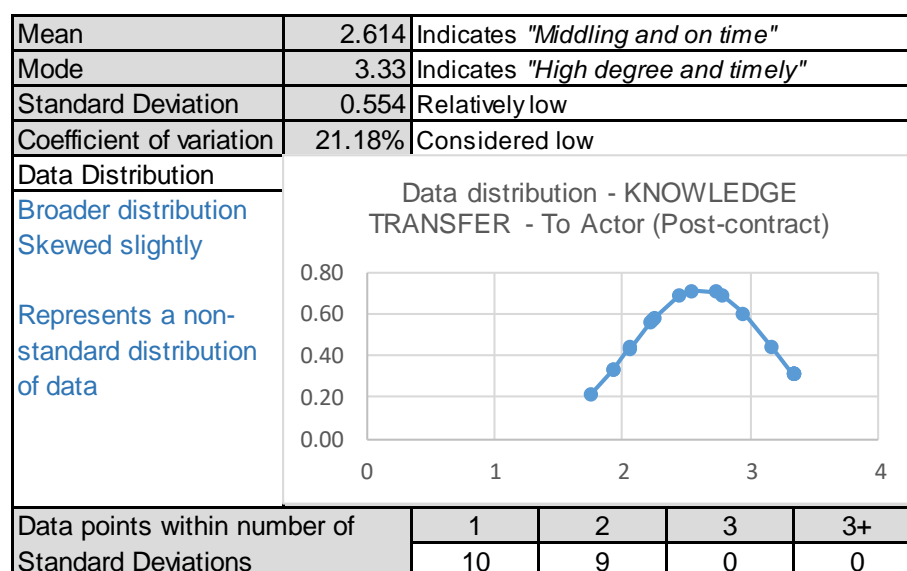
There are other actors (BSE and CPM4) who’s view on scoring significantly differed from others in the network, which lends itself to them having a separate, personal, view of how effective the knowledge transfer may have been. CQS1 has a higher average magnitude difference; but this was most likely due to their view what they were undertaking in the pre-contract phase; they were not involved in a number of the activities.

What degree of Transfer of Knowledge is there with each actor - To actor?

Three months following Contract execution

KNOWLEDGE TRANSFER TO ACTOR (POST): Individual scores response :

Figure D.3.6.6



KNOWLEDGE TRANSFER TO ACTOR (POST): Individual reciprocal scores response : Table D.3.6.6

	Average Score	Average difference	Average magnitude	Difference	Magnitude
CEC	2.06	-0.89	1.22	Less KT TO Actor	Significant difference
SPM1	2.77	0.00	1.11	More KT TO Actor	Significant difference
PM2	2.72	0.00	0.67	More KT TO Actor	Mid-range difference
LAr	1.92	-1.06	1.28	Less KT TO Actor	Significant difference
Arc1	2.53	-0.44	1.33	Less KT TO Actor	Significant difference
CSE2	2.25	-1.11	1.44	Less KT TO Actor	Significant difference
BSM	2.94	0.61	0.83	More KT TO Actor	Mid-range difference
BSE	2.22	-0.39	0.83	Less KT TO Actor	Mid-range difference
CQS	2.24	-0.22	0.78	Less KT TO Actor	Mid-range difference
CQS1	1.75	-0.83	1.17	Less KT TO Actor	Significant difference
CoL1	3.33	-0.94	1.39	Less KT TO Actor	Significant difference
CPM1	3.33	0.83	1.06	More KT TO Actor	Significant difference
CPM4	1.92	-1.11	1.11	Less KT TO Actor	Significant difference
CCM1	3.33	1.00	1.00	More KT TO Actor	Mid-range difference
CCM4	3.17	0.78	0.89	More KT TO Actor	Mid-range difference
CDM	2.44	-0.39	1.17	Less KT TO Actor	Significant difference
CME1	2.06	-0.06	1.50	Less KT TO Actor	Significant difference
SCME	3.33	2.11	1.56	More KT TO Actor	Significant difference
SCME	3.33	2.11	1.56	More KT TO Actor	Significant difference

Observations

The relative transfer of knowledge no longer seems to be reliant on whether Client or Contractor with a variety of views of how much knowledge is being transferred to other network members. This should be the case given the activities immediately following contract execution; there should be a high degree of transfer of knowledge as key activities kick off and the construction commences, raising queries etc. CME 1 continues to have a high magnitude difference (but a low average difference) between themselves and other actors which represents that a significant number do not believe there is knowledge being transferred effectively TO that actor. CSE2 is in a similar position, which should not necessarily be the case in the early stages of the delivery phase.

SCME has a high average difference and magnitude; this indicates they believe themselves to be transferring more knowledge to others than a significant number of the network believe. This disparity might indicate that a proportion of the network are not party to the information that is being issued by the MEP subcontract and supply chain.

Comparative observations

The movement of key measures from the data between the two time frames could indicate general trend, in the following way;

Movement from Pre to Post Contract	
Mode	0.17
Coefficient of variation	4.75%
Average score	-0.046
Average difference	-0.015
Average magnitude	0.085

- *Mode increasing*; slightly higher scoring
- *Coefficient of variation*; an increased difference in degree of Knowledge Transfer
- *Average score*; slightly reduced levels of Knowledge Transfer
- *Average difference*; slight reduction in network view

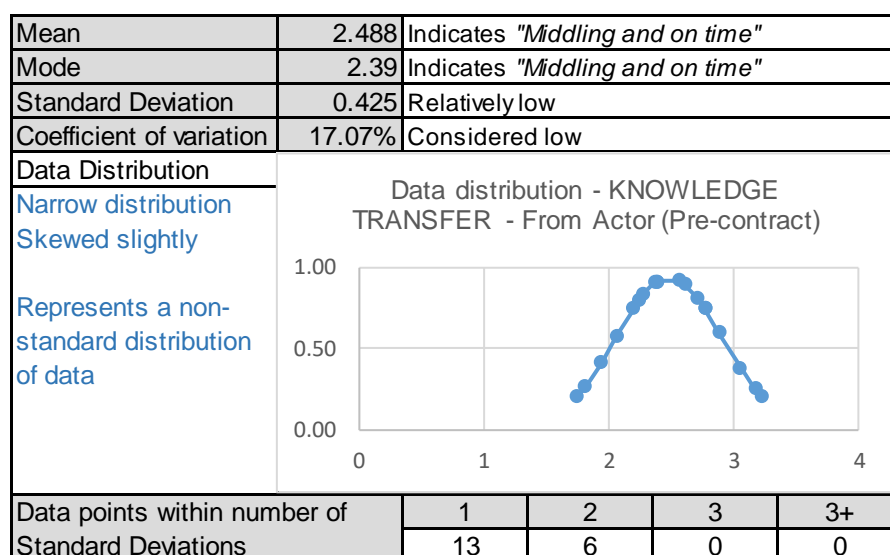
- *Average magnitude*; slight increase in the variation of difference between reciprocal scoring, slightly less reciprocally balanced view of Knowledge Transfer TO actors.

The network scoring between the two periods did not change a great deal, there were very slight adjustments in the comparisons made. The coefficient of variation increasing somewhat may indicate that there was a view that transfer of knowledge TO other actors in the network was less widespread following contract execution. This could be due to the activities being undertaken with the broader team and the enhanced involvement of the delivery team members that might have had less involvement in the pre-contract period.

What degree of Transfer of Knowledge is there with each actor - **From actor?**

Three months prior to Contract execution

KNOWLEDGE TRANSFER FROM ACTOR (PRE): Individual scores response
: Figure D.3.6.7



KNOWLEDGE TRANSFER FROM ACTOR (PRE): Individual reciprocal scores response : Table D.3.6.7

	Average Score	Average difference	Average magnitude	Difference	Magnitude
CEC	1.81	-0.72	0.94	Less KT FROM Actor	Mid-range difference
SPM1	2.62	-0.17	1.17	Less KT FROM Actor	Significant difference
PM2	2.39	0.11	0.78	More KT FROM Actor	Mid-range difference
LAr	2.29	-0.44	0.78	Less KT FROM Actor	Mid-range difference
Arc1	2.20	-0.67	1.00	Less KT FROM Actor	Mid-range difference
CSE2	2.25	-1.11	1.33	Less KT FROM Actor	Significant difference
BSM	2.89	0.72	1.06	More KT FROM Actor	Significant difference
BSE	2.07	-0.67	0.89	Less KT FROM Actor	Mid-range difference
CQS	3.18	-0.11	0.44	Less KT FROM Actor	Minimal difference
CQS1	2.57	-0.83	0.94	Less KT FROM Actor	Mid-range difference
CoL1	2.39	0.28	0.83	More KT FROM Actor	Mid-range difference
CPM1	3.06	0.61	0.83	More KT FROM Actor	Mid-range difference
CPM4	1.75	-0.72	0.94	Less KT FROM Actor	Mid-range difference
CCM1	2.72	0.33	0.67	More KT FROM Actor	Mid-range difference
CCM4	3.22	1.00	1.00	More KT FROM Actor	Mid-range difference
CDM	2.38	-0.50	0.50	Less KT FROM Actor	Minimal difference
CME1	1.94	0.00	0.89	More KT FROM Actor	Mid-range difference
SCME	2.78	1.50	1.11	More KT FROM Actor	Significant difference
SCME	2.78	1.50	1.11	More KT FROM Actor	Significant difference

Observations

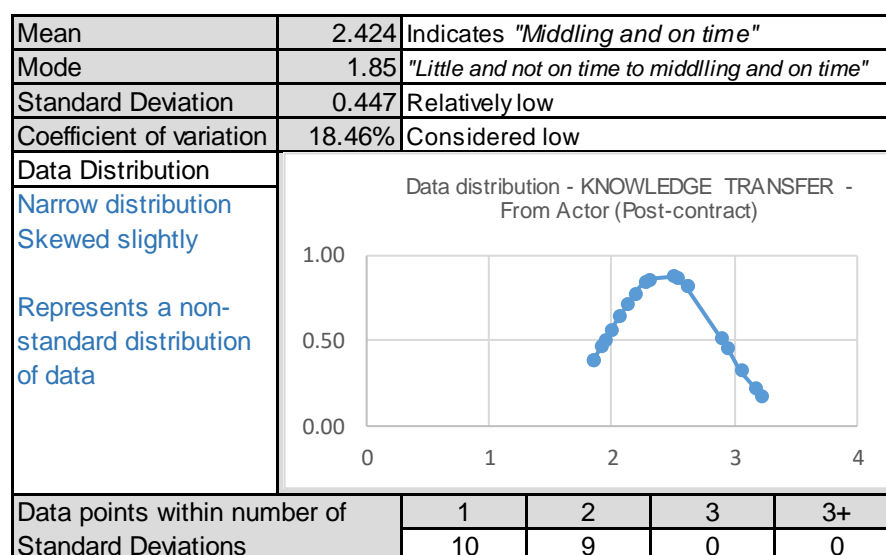
The network suggest that Knowledge transfer FROM other actors is very much *middling* and is less when compared to that transferred TO other actors in the pre-contract period; this indicates that, in general, the actors perceive that they are contributing more to the transfer of knowledge than those who should be transferring knowledge to them. In relation to building services, the actors involved in the pre-contract engagement provide a range of responses. Whilst, again, the MEP subcontractors (SCME) score highly, indicating that they perceived a high degree of information, the Designers (BSM and BSE) scored differently, and the Building Services Manager (CME1) score significantly lower, with high degrees of magnitude of divergent scoring. This represents a significant difference in views from those involved and could indicate an issue in itself on the consistency of the respondents. However, taking the scores on face value would intimate that the subcontractors believe that information was suitable and available, whilst those working with them believe that not to be the case. We should remind ourselves here on comments made in the interviews where some thought the MEP interaction to be a positive, whilst others had reservations on its benefits (or they were not involved); these two sources of data support one another.

CSE2's response, again reflecting earlier comments, shows that there is a considerable discrepancy between his view of the network and that of others who have plainly interacted with him, more effectively in their view. But others in the network also score generally lower and in a similar manner to CSE2.

What degree of Transfer of Knowledge is there with each actor - From actor?

Three months following Contract execution

KNOWLEDGE TRANSFER FROM ACTOR (POST): Individual scores response : *Figure D.3.6.8*



KNOWLEDGE TRANSFER FROM ACTOR (POST): Individual reciprocal scores response : *Table D.3.6.8*

	Average Score	Average difference	Average magnitude	Difference	Magnitude
CEC	2.19	-0.33	1.00	Less KT FROM Actor	Mid-range difference
SPM1	2.31	-0.11	0.89	Less KT FROM Actor	Mid-range difference
PM2	2.50	0.22	0.78	More KT FROM Actor	Mid-range difference
LAr	1.85	-0.78	1.00	Less KT FROM Actor	Mid-range difference
Arc1	2.07	-0.56	0.89	Less KT FROM Actor	Mid-range difference
CSE2	1.92	-1.11	1.11	Less KT FROM Actor	Significant difference
BSM	2.89	1.00	1.00	More KT FROM Actor	Mid-range difference
BSE	2.28	0.06	0.83	More KT FROM Actor	Mid-range difference
CQS	2.53	-0.11	0.67	Less KT FROM Actor	Mid-range difference
CQS1	2.00	-0.67	1.00	Less KT FROM Actor	Mid-range difference
CoL1	3.17	-0.78	1.11	Less KT FROM Actor	Significant difference
CPM1	3.22	0.72	0.72	More KT FROM Actor	Mid-range difference
CPM4	1.85	-1.06	1.06	Less KT FROM Actor	Significant difference
CCM1	3.06	0.72	0.72	More KT FROM Actor	Mid-range difference
CCM4	2.94	0.61	0.94	More KT FROM Actor	Mid-range difference
CDM	2.13	-0.61	0.72	Less KT FROM Actor	Mid-range difference
CME1	1.94	0.00	1.00	More KT FROM Actor	Mid-range difference
SCME	2.61	1.39	1.00	More KT FROM Actor	Mid-range difference
SCME	2.61	1.39	1.00	More KT FROM Actor	Mid-range difference

Observations

Notwithstanding CoL1's scoring (and has been previously noted his view on his position in the network post-contract), other marked actors with high magnitude differences are CSE2 (which could be in relation to his considered position within the network or the perception of information not being available) and CPM4. CPM4 would have had a central role at this stage and their scoring and view of levels of knowledge transfer from others is significant. Plainly they believe that knowledge was not suitably transferred.

Comparative observations

The movement of key measures from the data between the two time frames could indicate general trend, in the following way;

Movement from Pre to Post Contract	
Mode	-0.54
Coefficient of variation	1.39%
Average score	-0.064
Average difference	-0.006
Average magnitude	0.012

- *Mode decreasing*; lower Knowledge Transfer scoring
- *Coefficient of variation*; an increased difference in degree of Knowledge Transfer
- *Average score*; generally, marginally, decreased levels of Knowledge Transfer
- *Average difference*; virtually no change in reciprocal scoring
- *Average magnitude*; slight increase in the variation of difference between reciprocal scoring, less reciprocally balanced view of Knowledge Transfer

There were very slight differences between the two periods, with the most notable change being the increase in the coefficient of variation (albeit still small). This indicates a small widening of the view between the individuals of the network; the other smaller changes are likely to mean that the coefficient value is being impacted by one or more significant actor's scores. The slightly lesser scoring indicates that, generally the network considers there is less

knowledge forthcoming from the rest of the network following contract execution. With a collaborative procurement approach this is likely to be anticipated, and perhaps the difference *should* be higher.

When comparing the TO ACTOR to FROM ACTOR responses the following is observed.

	TO Actor			FROM Actor		
	pre	post	m'ment	pre	post	m'ment
Mean	2.66	2.61	-0.05	2.49	2.42	-0.06
Mode	3.17	3.33	0.17	2.39	1.85	-0.54

Table D.3.6.8.1 Knowledge transfer comparison

From this it appears that in regards knowledge transfer TO other network actors, there is an aberration in the Modal measure in how it is inferring an improvement in this rather than what the mean indicates. From this, it may be inferred that there are differing views within the network on the change in effective knowledge transfer, although the further indications within the data set to show that a number of the actors scoring was more positive between the two periods.

In regards FROM other network actors, there is a negative indication. This then, however slightly, indicates that generally the actors consider themselves to be transferring more knowledge than they are receiving from others in the network. It cannot be the case that is happening practically.

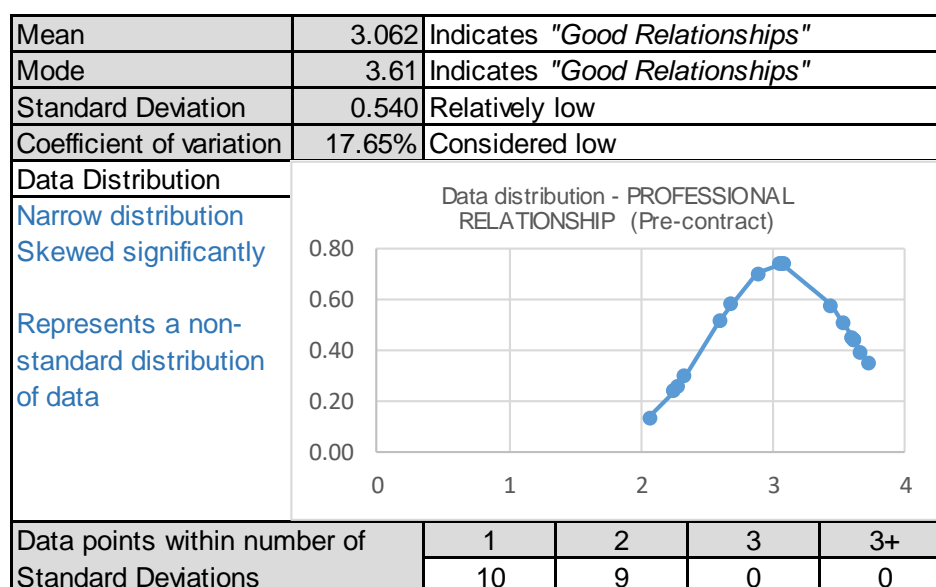
That the data represents a confused situation may be representative of the personal responses, driven by the context of the events both leading up to contract execution (where relationships were fraught) and the pressures of enacting the site activities once the contract was executed. It is also potentially a factor of the nature how individuals view the strength and validity of their professional input into project teams.

What is the manner of relationship between yourself and each actor?

Three months prior to Contract execution

PROFESSIONAL RELATIONSHIP (PRE): Individual scores response : *Figure*

D.3.6.9



PROFESSIONAL RELATIONSHIP (PRE): Individual reciprocal scores response : *Table D.3.6.9*

	Average Score	Average difference	Average magnitude	Difference	Magnitude
CEC	2.06	-1.28	1.50	Less positive	Significant difference
SPM1	3.08	-0.50	1.28	Less positive	Significant difference
PM2	2.28	-0.72	1.06	Less positive	Significant difference
LAr	3.07	-0.39	1.06	Less positive	Significant difference
Arc1	2.60	-0.94	1.17	Less positive	Significant difference
CSE2	2.25	-1.67	1.89	Less positive	Significant difference
BSM	2.89	0.00	0.89	More positive	Mid-range difference
BSE	3.60	0.00	1.11	More positive	Significant difference
CQS	3.53	-0.39	0.50	Less positive	Minimal difference
CQS1	3.07	-1.00	1.44	Less positive	Significant difference
CoL1	3.06	0.28	0.94	More positive	Mid-range difference
CPM1	3.72	0.83	0.83	More positive	Mid-range difference
CPM4	2.33	-0.78	1.44	Less positive	Significant difference
CCM1	3.67	0.72	0.83	More positive	Mid-range difference
CCM4	3.44	0.94	1.17	More positive	Significant difference
CDM	2.69	-0.39	0.83	Less positive	Mid-range difference
CME1	3.61	1.33	1.33	More positive	Significant difference
SCME	3.61	2.06	1.56	More positive	Significant difference
SCME	3.61	2.06	1.56	More positive	Significant difference

Observations

With a mean suggesting that the relationships are generally good, this refutes (to a degree) some of the comments made in the interviews. However, it is noted that just because one actor may not necessarily trust another, the “professional” relationship may still be relatively effective. actors of note in the scoring are CEC, who scored comparatively lower against the rest of the network. This intimates that they felt that their professional relations were merely *fair*. Given that 2.06 is their average score, one must note that a significant proportion would have been scored as *poor* or even *extremely poor*.

One actor of note is CSE2 who, reflecting other comments elsewhere, has a less positive view of the network relationships than is reciprocated by same, and by some margin with a high (highest) magnitude.

SCME, who considered that their relationships in the network were *good to excellent*, displayed quite a significant difference in scoring from other actors. They believed that relationships were better more broadly, which may not have been reflected by others.

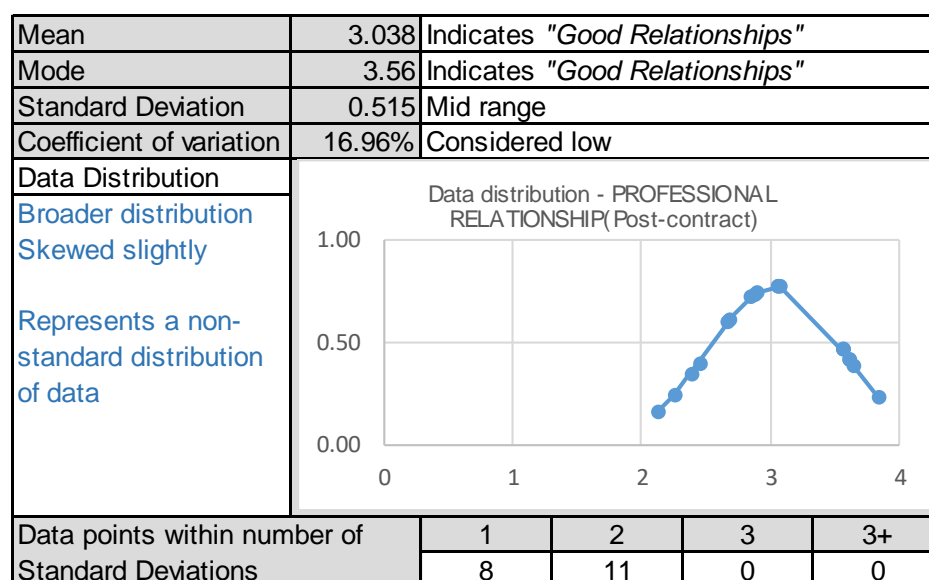
A general view would indicate that the Client team felt less positive in regards professional relationships than that of the Contractor team. One exception is CDM (Contractor’s Design Manager) who voiced the same view within interview having felt that some relationships were poor to the point of being obstructions to the delivery.

What is the manner of relationship between yourself and each actor?

Three months following Contract execution

PROFESSIONAL RELATIONSHIP (POST): Individual scores response :

Figure D.3.6.10



PROFESSIONAL RELATIONSHIP (POST): Individual reciprocal scores response : Table D.3.6.10

	Average Score	Average difference	Average magnitude	Difference	Magnitude
CEC	2.13	-1.11	1.44	Less positive	Significant difference
SPM1	3.08	-0.28	1.50	Less positive	Significant difference
PM2	2.44	-0.28	0.83	Less positive	Mid-range difference
LAr	2.85	-0.50	1.28	Less positive	Significant difference
Arc1	2.67	-0.61	1.06	Less positive	Significant difference
CSE2	2.25	-1.44	1.67	Less positive	Significant difference
BSM	2.89	0.28	0.94	More positive	Mid-range difference
BSE	3.06	0.17	0.94	More positive	Mid-range difference
CQS	3.65	0.00	0.22	More positive	Minimal difference
CQS1	2.88	-0.72	1.28	Less positive	Significant difference
CoL1	3.83	-1.28	1.50	Less positive	Significant difference
CPM1	3.61	0.67	0.89	More positive	Mid-range difference
CPM4	2.38	-1.33	1.33	Less positive	Significant difference
CCM1	3.56	0.78	1.00	More positive	Mid-range difference
CCM4	3.06	0.39	1.06	More positive	Significant difference
CDM	2.69	-0.50	0.94	Less positive	Mid-range difference
CME1	3.61	1.56	1.56	More positive	Significant difference
SCME	3.56	2.11	1.72	More positive	Significant difference
SCME	3.56	2.11	1.72	More positive	Significant difference

Observations

Still considered as “Good” relationships based on the Mean response, despite the Mode score indicating a somewhat lesser view. CEC considered that relationships improved in general terms following contract execution, which indicates that their view of the pre-contract period was less than positive. Those involved in the Building Services aspects all score highly reflecting the work undertaken in this area and the relationships required, but SCME still display quite a significant difference in scoring from other actors. They maintain relationships were better more broadly, which may not have been reflected by others.

CoL1 is potentially an outlier given their view of position in the network compared to others’ view. The delineation made between client and contractor in the pre-construction period on the positivity towards the relationships is degraded somewhat by a number of differing views on this.

Comparative observations

The movement of key measures from the data between the two time frames could indicate general trend, in the following way;

Movement from Pre to Post Contract	
Mode	-0.06
Coefficient of variation	-0.69%
Average score	-0.023
Average difference	-0.009
Average magnitude	0.026

- *Mode decreasing*; slightly lower scoring of the wider network
- *Coefficient of variation*; a very slightly decreased difference in degree of view of relationship
- *Average score*; minimal decrease of scoring
- *Average difference*; minimal change in reciprocal scoring
- *Average magnitude*; minimal increase in the variation of difference between reciprocal scoring, slightly less reciprocally balanced view of the relationships

As a network there was very little change in view of the quality of the professional relationships between the two periods, but overall the MEAN scoring decreased very slightly. The pre-construction period and the activities involved meant that some actors HAD to interact more closely, whereas once the contract was executed this may not have been the case. Whilst still professionally linked, it could be that there was a conscious or sub-conscious slight change between some of the network links. If we then consider the MODE (-0.06) and the MEAN (-0.023), it suggests a marginal decrease in positivity towards the relationships. This is reflected in the RII score earlier in the case study, with a very slightly less positive view.

D.3.7 Case Study Summary

It was surmised by some actors responses that this project would benefit from the lessons learned of the initial project (BPS). However it would appear this might not have been the case, at least not in the timeframe being reviewed.

There were some issues still noted within the interviews and in the scoring provided; this might be expected given the high degree of commonality in some of the network.

Refer to case study 1 (BPS) for summary comments as they are largely the same.

In terms of summarising the response to the over-arching research questions, table D.3.6.11 provides this.

Research Question topic	Case Study position
Levels of Trust	Defined as "Mostly Trusting", reducing post contract
Degree of Collaboration	A "middling to high degree" of collaboration, reducing post contract
Extents of Knowledge Transfer	Between "middling and on time" and "High degree and timely" view TO other Actors, but a lesser view when considering FROM Actors. Individuals appear to see themselves transferring more TO others than they get FROM others.
Professional Relationship of the Network	"Good" both pre and post contract, with a very slight decrease after contract execution.
Client Objectives defined	Noted as being an "essential" requirement. Poor definition of objectives with some commenting on this not being provided with any clarity (i.e. not in written form). Confusion apparent from the network (including with the "project charter") and this caused issues within the activities. A lack of clarity sometimes means the Contractors experience can not be applied fully.
Building Services Procurement	Those involved in the early engagement provide positive comments on this aspect and note that without this being undertaken, delivery to development programme would have been impossible. Trust, Collaboration, Knowledge Transfer and professional relationships generally score higher within the network from those involved in this aspect.

Table D.3.6.11 : Case Study position summary

D.4 Side Case Study – Renton Primary School Campus (RPS)



D.4.1 Case study outline

Renton Primary School Campus was a replacement school procured by West Dunbartonshire Council (WDC) to replace existing facilities. As is described elsewhere, this project was not initially part of the research methodology but was considered appropriate to review in the context of the other school case studies. It is of similar scale and value to that of the 4 other case studies, has been procured under a slightly different procurement method, and has the same Contractor involved as case studies 1 to 3. This case study is not in the same format as 0-4, as the level of analysis is not the same, but provides observations in the relevant areas.

D.4.2 Collaborative team delivery

The main actors from the RPC project team provided a presentation at the Education Buildings Scotland conference 2019, where they extolled the benefits of the collaborative procurement approach, they had taken to deliver their project. They talked about what factors of collaboration had been important in setting out on their journey and how this had proven beneficial, at least in their experience.

The researcher was introduced to these main actors (by one of the representatives from the Contractor involved in this project and case studies 1, 2 and 3) and requested an opportunity to further investigate the specifics of

their approach and a number of the outcomes at that stage (financial close, awaiting approval to commence construction activities). The points which are particularly pertinent to this research, reflecting some of the positions raised from the review of existing evidence and findings from other parts of the study, are highlighted in order to indicate a degree of triangulation between this *side-study* and the overall research.

D.4.3 Key points discussed with Renton team

The points discussed with the Renton team are;

- Renton was an evolution of previously delivered projects, however it was the first project with education partners directly involved throughout process with design development...not kept separate from design process.
- **The Client had previous experience of working with the Contractor and their Designers**
- The Client was a **knowledgeable Client** – no naivety in process or approach but education was the driving factor and looked for specialist input to develop not only spaces, but team understood how teaching could be delivered in the spaces.
- **The Client knew they wanted to take a different approach than on previous projects, but still wished to work collaboratively and include early engagement with the right people.**
- It was a wholly *education driven* approach; recognising the SOCIAL VALUE aspect of the project.
- Market research was undertaken by Client team on which procurement vehicle to utilise given there was no available internal framework.
- The internal Client team “interviewed” prospective procurement delivery options.
- Scottish Procurement Alliance (SPA) was selected; Mini competition approach, 2 stage Design and Build (with Contractor Design team), NEC3 Contract.

- **As part of the first stage, specialist contractors were to be utilised to add value and innovation** and avoid risks (early surveys etc).
- There was a robust options appraisal undertaken to ensure compliance with internal governance. Meant the process was answerable and bespoke.
- There was explicit scoring criteria based on requirements identified and lessons learned. **Key aspects were identified within the tender to ensure Client requirements were made clear.** Interviews formed an integral part of the selection criteria. **The Client were clear that they wanted to know “who can we work with” – the *people* aspect of construction.**
- **Client was looking for enhanced offering from the Contractor teams. Looking for the “Value Add” from the early up-front resource based offering.**
- **Timing of collaboration was essential; Stage 0 inclusion. Essential that the broader supply chain was utilised effectively and at the earliest appropriate juncture.**
- Stakeholder expectations – Managed early, early Buy-in from them, feedback loop, constant review, strategic decisions made, “Clear vision” conveyed, lessons learned deployed; Client driven. Included pre-work by the team for differentiations within the brief.
- **Conversations were always open** – with consensus sought at the end of these conversations.
- **Early key conversations essential** – have impacts on overall project.
- **The early engagement with Contractor induced a degree of control,** managing expectations and at times acting as a brake on runaway expectations.
- **In developing the project a focus on the “context” was key** and was referred to at all points.
- **The approach of having a small, tight, team with “no hangers on” brought benefits to decision making and the TEAM ethos was key to success.**

- How did they deal with problems? They weren't really seen as problems, more as challenges, and they were dealt with effectively by the **team approach**. There was no "fire-fighting" – there were no real fires!
- The key direction for the project was that Education led on developing the brief, along with collaborative discussion to understand how the building would be used.
- With the Contractor engaged as part of the **Early Contractor Involvement**, risk review was carried out at an early stage and on an ongoing basis. This meant that focused efforts were deployed (secondary surveys etc) to mitigate where possible.
- **The Contractor was able to input** to setting/agreeing the cost caps and ensuring that at each key stage these were still being aligned with, making design/commercial decisions with the entire team.
- Allocation of Risk shared to the most relevant party.
- **Whole team engaged to ensure delivery to requirements; a multidirectional approach**
- Whole Life cost was considered and had an impact on aspects of MEP design; involved FM and Asset teams from Council.
- Decision NOT to meet the requirements of BB101:2018 was made at an early stage given the significant costs involved.
- Planning – there was a high degree of input, but the process was very well managed. Whilst this did impact at times, the programme was well managed and still met all key milestones.

D.4.4 Summary view of key aspects from Renton team

As part of the discussions with the team, they were asked specifically to consider key aspects of this research's focus in relation to their project and their comments were;

- **Trust** – was paramount between the parties and was engendered by the engagement's Terms and Conditions

- **Knowledge Transfer** – was open and exhaustive. “*Daft laddie*” questions were easily asked and equally well answered. An environment of enquiry and response was clearly key to the process.
- **Professional Relationship / Team connection** – obviously strong and key to delivery. Reliance on each other to ensure delivery, with no one wanting to be the one to let others down.
- **Client Brief Definition** – robust, informed and a reference point for all decisions; Education led.
- **Building Services Outcomes** – affected by team input and key decisions being made early and collaboratively.
- **Quality versus Cost** – 60% Quality / 40% cost – looks to deliver *value* rather than base cost
- **An ethos of openness was apparent** and was central to the process.
- **People** delivered.

D.4.5 Renton team view on other aspects of the Research

As part of the discussions with the Renton team, they were asked to also look at a number of other aspects of the research. These were;

- *Ranking the “Top 10 benefits of Collaborative working” as Constructing Excellence (2015)*
- *Providing scores for the top 20 ranked aspects of collaboration according to research by Hughes et al (2012)*
- *Providing a view on the Research’s Propositions, including rival explanations, regarding aspects of Collaborative working*

The following are the outcomes of this.

Ranking the “Top 10 benefits of Collaborative working” as Constructing Excellence (2015)

Original Research	Benefit of Collaborative Working	Pilot study Focus group	Renton team Scores	Difference
1	Opportunities and risks are more transparent and manageable.	1	2	+/- 1
2	Solutions are more appropriate and more buildable.	2	6	>3
3	Everyone is able to contribute; you get to use all the experience in your team not just some of it.	4	1	>3
4	More innovation from all team members.	6	7	+/- 1
5	It's more enjoyable and more satisfying.	5	5	+/- 1
6	Shared problem solving leads to better problem resolution.	3	4	+/- 1
7	Time and cost are more predictable, so are outcomes and profit.	7	8	+/- 1
8	Whole life implications are actually considered.	8	3	>3
9	It's cheaper.	10	9	+/- 1
10	It's quicker.	9	10	+/- 1

Table D.4.1 Renton team view of “Top 10 benefits of collaborative working”

As a stand-alone exercise it is noted that 7 of the 10 benefits are ranked within plus or minus 1 ranking of those from the Preliminary outcome rankings (which themselves were not significantly different to the original research). This implies that those involved in the Renton project have similar views to the broader practitioners involved in both the original research and that of the Focus-groups; they are not unusual. They did however rank as their highest benefit that “everyone is able to contribute”. This was clearly a factor for them in the narrative.

Providing scores for the top 20 ranked aspects of collaboration according to research by Hughes *et al* (2012)

Rather than repeat the table again, the aspects of collaboration that the Renton team considered to be “essential” (scoring 3 on the Hughes *et al* scale) are noted here.

- An environment of open dialogue exists between all parties
- A common aim is shared by all contributors to the project
- Collaboration creates a problem-solving environment
- Team spirit exists between all personnel involved in the project
- The contract supports collaboration
- There is early involvement of key members of the supply chain
- Collaboration produces a win/win outcome

These plainly reflect the journey the Renton team had been on when discussing these aspects and some of the direct comments made by them in the narrative aspects of this case study above. The majority of the remaining aspects were ranked as “Desirable” (2), with only one being classed as “Nice to have / not necessary” (1); Risks are allocated fairly to the parties. Again, those involved in this project align, in a general sense, with other practitioners.

Providing a view on the Research's Propositions, including rival explanations, regarding aspects of Collaborative working

Finally, the Renton team were asked to review the table detailing above and asked to contemplate which was the most relevant as far as they were concerned in their project AND in the broader sense.

Their considered responses are highlighted in blue below and indicate that in two instance they do not directly agree with the outline propositions detailed;

Ref	Proposition	Rival explanation (1)	Rival explanation (2)
1	That high levels of trust between project actors enhances the outcomes of a project	Project Outcomes are not reliant on high levels of trust between project actors	There is no correlation between the levels of project actor trust and project delivery
2	Trust between project actors is necessary for effective knowledge transfer	Knowledge Transfer can be effective without trust between project actors	Project knowledge transfer relies on many factors, which may or may not include trust
3	That a disparity between actors' perceptions of the level of trust between them can cause conflict and barriers within the project network.	That network relationships are not affected by the perceptions of levels of trust, even if they differ between actors	Inter-project relationships rely on many factors, which may or may not include trust
4	That poorly defined client value objectives have a detrimental effect on the performance of the project delivery team; and that it also affects their ability to collaborate	The level of definition from the client of their value objectives has no effect on the project delivery teams performance, nor their ability to collaborate	That overly prescriptive client's value objective definition has a detrimental effect on the performance of the project delivery team; and that it also affects their ability to collaborate
5	That the collaborative early engagement with the Building Services supply chain has a positive effect on delivering to the client's value outcomes	Collaborative early engagement with the Building Services supply chain has no impact on delivering to the Client's defined value outcomes	That the collaborative early engagement with the Building Services supply chain has a negative effect on delivering to the client's value outcomes

Table D.4.2 Renton team view of Propositions

D.4.6 Case Study Summary

When the Renton team were originally canvassed, they were approaching the end of the development phase of the project. At the time of writing the project has now been handed over to the Client and is considered a success by all parties involved; at the recent Learning Places Scotland conference (2022), the Client lead described it, positively, as being “*a project without equal*”. The nature of relationships involved and the collaboration from start to finish has been cited as one of the primary factors of the success.

In terms of summarising the response to the over-arching research questions, table D.4.3 provides this.

Research Question topic	Case Study position
Levels of Trust	Levels of trust were commented on as being high in the project team and led to effective outcomes
Degree of Collaboration	A very high degree of collaboration from the very outset until the project conclusion
Extents of Knowledge Transfer	Expressed as being done in such a way as to ensure know one was in any doubt over any aspect. was open and exhaustive with an environment of enquiry and response being key to the process.
Professional Relationship of the Network	Strong and key to delivery. Reliance on each other to ensure delivery, with no one wanting to be the one to let others down.
Client Objectives defined	Noted as being robust, informed and a reference point for all decisions; an <i>education led</i> process as the basis of decision making.
Building Services Procurement	Was affected by team input and key decisions being made early and collaboratively.

Table D.4.3 : Case Study position summary

