How do Consulting Engineers interact with their Clients?

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Abstract: *This paper draws on a review of literature of consulting engineers' client service quality and studies of engineering work to show that there is little research that can explain consistently low perceptions of consulting engineers' service quality. This finding motivated a preliminary study of ways in which consulting engineers interact with their clients. Six extensive qualitative interviews of consulting engineers provided rich data for analysis. Analysis of the interview data draws on the engineering communication literature and shows that difficulties with client interaction can be traced to misunderstandings by educators about the role of communication in engineering practice. Engineering communication is almost always described as an information transfer process from an engineer to other people. This limited view of communication creates difficulties in the workplace. The widespread and limited understanding of engineering practice among educators as a problem-solving activity leads to fundamental misunderstanding of accreditation requirements for communication skills. Change requires a richer view of engineering practice as an intertwined social and technical discipline.*

Introduction

This work started with the intriguing observation that consulting engineers are rated at the bottom in terms of service quality among other professionals or professional firms (Beaton, 2007). A search of relevant literature did not seem to provide any useful explanation for this and little guidance on how the consulting engineers might improve their service quality (Tan, 2009). This led us to the question in the title of this paper. This paper includes a brief literature review and preliminary results of a pilot study and concludes with suggestions relevant for engineering educators. We identify the key issue of low client service quality which relates to the ways engineers interact with their clients, and how this affects perceptions of their service quality**.** We decided to study interactions between consulting engineers and their clients in the construction industry. In our pilot study, we have also presented an extensive literature review on service quality (Tan, 2009).

Literature Reviews on Communication

To study interaction is to study communication. Our literature search revealed a wide range of topics on communication. Nevertheless, this paper includes only literature on communication relevant to engineers. To begin with, according to Carey (2008), communication is a form of action, or better, interaction. Roberts & O'Reilly (1979) labeled communication as an important component of individual attitude and behaviour. Later, Hellweg (1982) observed that the existence of effective communication within an organization would enhance worker productivity. Consequently, Cheng (2006) affirmed that clients consider effective communications with their service providers as being most important in determining client satisfaction levels.

Brewer (2001) identified poor communication issue as the cause of most of the performance problems in the construction industry. Furthermore, Cheng (2001) indicated that mutual trust, open communication, and effective co-ordination are critical factors affecting construction partnering. Additionally, Sheath (1996) described the benefit of an improved design and construction process which facilitates team working and effective communication between participants.

Next, on teamwork and leadership, Brumm et.al (2006) emphasized that communication is a pre-requisite for teamwork. Similarly, Cerni (2008) proposed that it may be necessary for the leader to communicate effectively, show willingness and ability to promote individual relationships with other.

Equally, Lapierre (1999) regarded competence, reliability, and communication as good indicators of quality. Nonetheless, Sharma (1999) proposed that effective communications must include both the formal and informal contact between the professional and the client.
In an education context, there have been concerns about communication skills for some time. For example, Wager (1972) suggested that students require more preparation in written communication skills as he noticed that few of the student submissions were satisfactory in quality. Furthermore, McGregor (1998) also affirmed the importance of developing the communication (written documentation) skills of engineering students. In addition, McGregor et al.(2000) voiced the imperative for improving the ability (writing) of engineers to communicate with professional colleagues, non-technical coworkers and the community.
The current trend to incorporate communication tasks into engineering course, is a positive curricular change, however, communication education and research have often focused only on written communication and formal presentation skills. For instance, Stevenson (2002) offers numerous strategies relating to the writing process. However, Thilmany (2004) noted the typical interpretation of communication ignores listening skills. Moreover, Williams (2002) expressed concern that true effective engineering communication is the critical thinking and audience analysis and not focus on grammar and punctuation. Specifically, Riemer (2002) declared that engineering graduates require an ever-increasing range of skills which include communication skills to maintain relevance with the global environment of the new millennium. Correspondingly, Prados (2005) claimed that effective collaboration requires not only the ability of participants to communicate in a common language, but also the assurance of a common level of technical understanding, given the global diversity of systems for educating engineers. Likewise, Ravesteijn (2006) presented a theoretical framework with regard to engineering and society and argued that this competence requires a good understanding of the social dynamics of technology as well as the ability to communicate on the level of facts, values and emotions. Still, Bidandar (2006) commented that the next generation of engineers will need to possess the ability to work seamlessly across cultures, and have outstanding communication skills.

Our review found that the engineering education literature says little about the function of communication beyond the transfer of information to others. For example, Galloway (2007, p. 26) defined communication as information transfer.

Research Question

Our review of relevant literature led us to ponder what the role of communication in engineering practice might be, and how our education system could assist in helping our engineering students to better master the relevant communication skills.

Method

We decided to conduct a qualitative study since there is an absence of literature providing coherent understanding in perceptions of consulting engineering service quality. Also, there are no universal or mutually agreeable variables on engineering communication on which we could plan a quantitative study. The interview method was selected as it is an excellent way of accessing consulting engineers' perceptions, meanings, definitions of situations and constructions of reality, and one of the most powerful ways we have of understanding the perceptions of people. Besides, valuable information can be gained quickly from the participants.

The semi-structured interviews for this study were conducted with four male and two female consulting engineers, involved in the local construction industry. Since this is a preliminary study, this sample size of six participants is sufficient, and our choice of various disciplines is representative of the target companies that we wish to study.

Table 1 Participant Details

Discipline	Structural	Mechanical	Electrical	Civil	Environmental	Mechatronics
Experience	15 years	7 years	25 years	25 years	14 years	36 years

The participants were asked about how they carry out their daily work and interact with the other project participants, what their expectations from their clients are, and also their

perceptions of service quality. The evidence was the data (text) collected from the interview conversations of the consulting engineers (participants). The sources of qualitative data were from the field notes and transcriptions of the interview conversations, which were recorded and then fully transcribed to text. The data were analysed using a three step process of data reduction, data display and conclusion drawing. (Miles & Huberman, 1994).

Similar qualitative studies of engineering practice have been conducted in the past (Bucciarelli, 1994; Faulkner, 2007; Trevelyan, 2007; Vinck, 2003; Zussman, 1985).

Findings

We learned from our pilot study (Tan, 2008) that the consulting engineers deem that their clients are the project architect and also the person who signed a contract with their firm.

Negotiation

Structural engineers told us that they have to negotiate with the architects. For example, in the following quotation, we hear a structural engineer's perspective on a typical negotiation.

> Q: Please tell me how do you obtain the necessary design requirements from the architect?
> R: What I do is, I start trying to get everything possibly can from an architect. So if I stabilized that 10-storey building, we obviously are going to have a lift going down to the bottom, the stairs is going right down to the bottom and half a dozen shear walls. Now if I know I only need two shear walls, in my mind they are the major shear walls, the lift core also goes down there, I also say I need that one there and that one there, so I got four because they won't give you all of them. They'll take that one away and say you can't have that one so I'll start by asking for more than I need, so when the negotiation finishes you got an efficient structure. If you start with an efficient structure, they'll say you can't have that shear wall then you got to design something that is horrific. You always start with more and get down to what we wanted. I supposed you start with more than you wanted and get down to less than that.

We can see from this passage that the engineer sees the negotiation in terms of resolving differences in the respective priorities for the use of physical space in the building structure. The engineer sees the architect looking for spaces unobstructed by the structural elements such as shear walls. On the other hand, the engineer desires to design simple, yet sound building: "They'll take that one away and say you can't have that one". Note that we only interviewed the engineer so we cannot infer the viewpoint of the architect from this one-sided account. However, we can see that the engineer has to negotiate in terms of structural space in this instance. In the response to the next question, we see additional dimensions of negotiation.

> Q: What is the not so interesting part of your work, for example, the time factor?
> R: I think engineers negotiate away time, you are always under time pressure, people always want things quicker and it's difficult to say no, I need another 3 weeks. Because you are worried that they will get someone else to do the job, so sometime you got to agree with tight timeframe but as well they're always under pressure to make you tighter. So sometime in order to get work, we negotiate how much time we could have. We don't actually stand up that much as a profession. We don't really say this is going to take 10 weeks, that's it, if you don't like, you could go away.

Here we see the engineer talking about the pressure from his client to complete his work in less time (and therefore at less cost to the client, either from reduced fees, or savings in project duration or both). In both negotiations, we can see that there are complex two-way communication processes involved. The engineer wants a simple, safe structure so he tries to persuade the architect to retain structural supporting elements, and to allow a reasonable time to complete the design of an "efficient structure". The engineer tries to start with excess structural elements (inefficient) so that he does not end up giving away so much that he will end up with a very difficult design: "got to design something that is horrific". Implicit in this, at the same time, the engineer is trying to ascertain what the architect is prepared to agree on, in terms of open space free of structural elements and a reasonable design time. All this has to be based on experience which guides the engineer's understanding of what kinds of buildings will be easy to design quickly, and how much time the design is likely to require.

Interpersonal Skill

The engineer told us that he has to rely on interpersonal skills and the ability to talk and work with different types of personality to get his job done, as explained in the following quotation.

> Q: How do you communicate with the team members and stakeholders in the project?
> R: You certainly have to develop skill on ways to talk to people of varying professions. You have to be able to talk to the steel fixer on site, that doesn't make them feel you are better than them, that is a working together thing, they are helping you and you start off as an engineer, the site supervisor know more than you, they know a lot more than are helping them. And then you got to work out how to talk to the site supervisor. When they have been building for 25, 30 years, and you just graduated.

Here we see that this engineer had to overcome natural hesitance when talking with someone who is both older and much more knowledgeable, and risk seeming to be ignorant and perhaps naive: "You certainly have to develop skill on ways to talk to people of varying professions". He has to utilise his communication and interpersonal skills, in addition to his technical competencies, to align the project members' objectives with the project or organizational goal in order to complete the work.

Service Quality

Clients and engineers may not mean the same thing about service quality. In the following replies to our query of the definition of service quality, we see an engineer's perceptions of service quality and what their clients value.

> Q: What do you think service quality is?
> R: Service quality first of all means to be able to produce good documents, a good set of drawing that people can follow on the building site. You got to be able to do a good design structurally and draw it well so that people can build your job. But through that process, you have to be able to communicate with your client, with your architect, to point things out, to discuss thing, to be flexible, to be able to form a relationship. If no one could talk to you then it's not really all that great. You got to be able to interact with people as well. So, in terms of overall service quality, I think engineers will be judged on how well they can communicate and also how good their documents are.

The engineer therefore, thinks that good service quality starts with good quality documentation, but is supported by good communication, flexibility, and relationship building: "Service quality means good documents... flexible ... able to form a relationship... can communicate".
Another engineer emphasized communications and sending feedback:

> Q: In your opinion, what do the clients value most?
> R: Communications with clients has always been a high priority with consulting engineers and feedback has recently been not enough and not at the right time

In several instances, we were told about junior engineers who may think they have done the design and drawings correctly, and if there are no problems on site they assume everything is satisfactory. However, as observed during one of the interviews, the participant received a phone call from a client in the Eastern States of Australia. She explained that the client was complaining about one of her site engineers, who failed to call the client to update the progress of the project. In this case, the client may value service quality in terms of having regular feedback from the engineer.

Client Expectations & Perceptions

In this excerpt, we hear from an electrical engineer on the importance of clearly understanding the expectations of the clients and managing their expectations.

> Q: Please tell me the difficult parts of dealing with the client?
> R: The difficult part I think is to manage the expectation on the client's part. Clients will very often write a specification or a contract requirement that of course, (they think that) the supplier side will take literally, they will write with best intent but in their head their expectation might be different; for various reasons, they will expect more. Now, there will be implied expectations that are not there (in writing), therefore there will be at various times during the project, potential for conflict. So you have to be careful of what sort of expectation clearly, there is (the) difficulty of managing, at the end of the day ...but there are times when you have to stand your ground, but that can be difficult also.

Here we see that it is necessary for the engineers to clarify with their clients their needs and wants at the beginning of the project. In fact, Castell (2004) also advocated that a client briefing is essentially a communication process and is a necessary step in the identification and eventual interpretation of the client's requirement. Therefore, successful briefing requires the accurate transfer of information between a client and their project team. This requires much more than a simple, one way written communication.

The following quotation reveals another issue in client perception: the client may not understand what it takes for a consulting engineer to come up with his proposed solution. An electrical consulting engineer talked about this issue:

> Q: Please tell me what are the expectations of clients?
> R: The investigation part of the study may only take one or two days, and we said to them there will be a period of testing, a period of analysis, and (then) we write our report. We do try to give a timeline, but nonetheless, what they see is three days in the field, they don't understand why, for a report that only runs for five pages, why it takes six weeks to produce those five pages from three days in the field. And so very often those expectations are based on lack of knowledge of what we produced in the background that they don't see, that's why managing their expectation is so important.

This engineer's view that clients may be unaware of the background work necessary to perform his service is also confirmed by Stewart (1998) who advocated that a professional service provider should try to educate the clients on what work is required, in this instance to assess engineering feasibilities and limitations. At times, they may have to manage the client's unrealistic expectations. Therefore, we can see further objectives of communication with clients: perception management and education simultaneously.

Discussion

This paper examines the problems consulting engineers encounter while communicating with their clients. We found consulting engineers are inevitably involved in negotiating for a realistic time frame and contract specification, influencing clients' perceptions and the value and soundness of their concepts and designs, and building trust with their clients. In this case, negotiation includes listening, clarifying, and converting clients' implicit wants to explicit requirements. Influencing involves persuading, convincing, educating, marketing, and managing clients' expectations. Trust building involves networking, checking, feedback, connecting, sensitivity to cultural differences, and relationship building. Consulting engineers know that they are judged by their clients not only on their technical skills but also their social skills, among other attributes. Consulting engineers are required to engage in social interaction with a wide range of people, including tradesmen, project managers, project engineers, contractors, and suppliers on site; draftspersons in the design office, engineers of other disciplines, and other professionals, architect, as well as client. The consulting engineers are expected to adapt themselves to social-cultural requirements in the workforce. They require effective communicative skills to negotiate, influence, and build trust with their clients. Therefore, they need to learn to cultivate relevant skills such as effective communication to tailor their actions and responses accordingly. Since most engineers find it difficult to interact in the workplace, the key issue here is how the consulting engineers can learn to communicate better, and how the education system could facilitate in this? Consulting engineers are required to use their human capital (cognitive skills, technical, and business/commercial knowledge), and also social capital (social-political intelligence) to accomplish their tasks. [Note that the term social capital is quoted from Hall (2004)]. Social skills enable consulting engineers to use communicative competency to leverage their human capitals. This is possible through management of self and management of client expectations. In this way, consulting engineers may be able to differentiate themselves from other professionals, for example, that they are not only solving technical problems and looking after the interests of their clients but also at the same time serving the wider community.

The insights into engineering communication emerging from our preliminary study reveals a much richer view of communication than is typically taken in engineering education. In many engineering education contexts, communication is only treated in terms of information transfer and, usually, only in one direction: from the engineer to other people. Many employers have criticized communication abilities of engineering graduates. Is it possible that the contrast between the narrow 'information output' perspective taken by engineering educators and the richness of communication that is required in engineering practice lies behind these criticisms? We need further data to trace the links between education and practice before we can answer this crucial question for engineering educators.

In this preliminary study, we only interviewed engineers. We plan to expand the focus to include clients and other participants who influence perceptions of service quality in a more comprehensive study.

Conclusion

We have learned from our pilot study that consulting engineers value technical competencies, good quality documentation, and timely delivery. Communication seems to be seen as important but secondary to these by the participants in our study. From the analysis of the interview conversations, we see that consulting engineers have to coordinate work by others, and collaborate with others by using their communicative and social competencies. The aims of communication go far beyond the simple notions of communication skills usually emphasized by engineering educators: formal presentations, information transfer, and written documentation. This limited view of the role of communication imparted by educators may create difficulties in the workplace. A well-designed engineering education curriculum requires a richer view of engineering practice as an intertwined social and technical discipline. We also have to take into consideration the continuing worldwide increase in communication and interconnectedness, the ability to function on multidisciplinary and multicultural teams, and to understand the impact of engineering solutions in a global and societal context.

We hope this paper could contribute to a richer understanding of the requirements for communication skills in engineering practice, for the quality control of education, and for regulating the professional practice. Close examination changes our notions of engineering practice and educators need to respond to this change.

References

Beaton, C. (2007). The Annual Professions Study

Bidandar, B., Arisoy, O., & Shuman, L. J. (2006). Offshoring manufacturing: Implications for engineering jobs and education: A survey and case study. *Robotics and Computer-Integrated Manufacturing, 22*.

Brewer, G., Gameson, R., Gajendran, T., Kolomy, R., Lenard, D., MacKee, J., et al. (2001). Project Team Integration: Communication, Coordination and Decision Support. Part A: Scoping Studies.

Brumm, T. J., Hanneman, L. F., & Mickelson, S. K. (2006). Assessing and Developing Program Outcomes through Workplace Competencies. *International Journal of Engineering Education, 22*(1), 123-129.

Bucciarelli, L. L. (1994). *Designing Engineers*. Cambridge, Massachusetts: MIT Press.

Carey, J. W. (2008). *Communication As Culture*.

Castell, L. (2004). Current Trends in Client Briefing: A Survey of Architectural Practices in Western Australia. Editorial Comments on Special Edition: Working Together, 1. *The International Journal of Construction Management 4*, 1-12.

Cerni, T., Curtis, G., & Colmar, S. (2008). Information Processing and Leadership Styles: Constructive Thinking and Transformational Leadership. *Journal of Leadership Studies, 2*(1).

Cheng, E. W. L., & Li, H. (2001). Development of a conceptual model of construction partnering. *Engineering Construction & Architectural Management 8*(4), 292-303.

Cheng, J. (2006). The satisfaction levels of UK construction clients based on the performance of consultants: Results of a case study. *Engineering, Construction and Architectural Management, 13*(6), 567.

Faulkner, W. (2007). Nuts and Bolts and People': Gender-Troubled Engineering Identities. *Social studies of science, 37*(3), 331.

Galloway, P. D. (2007). *The 21st-Century Engineer: A Proposal for Engineering Education Reform*.

Hall, A. T., Blass, F. R., Ferris, G. R., & Massengale, R. (2004). Leader reputation and accountability in organizations: Implications for dysfunctional leader behavior. *The Leadership Quarterly, 15*(4).

Hellweg, S. A., & Phillips, S. L. (1982). Communication and Productivity in Organizations. *Public Productivity Review, 6*(4), 276-288.

Lapierre, J., Filiatrault, P., & Chebat, J.-C. (1999). Value Strategy Rather Than Quality Strategy: A Case of Business-to-Business Professional Services. *Journal of Business Research, 45*(2), 235-246.

McGregor, H., & McGregor, C. (1998). Documentation in the Australian Engineering Workplace. *Australasian Journal of Engineering Education, 8*(1), 13-24.

McGregor, H., Saunders, S., Fry, K., & Taylor, E. (2000). Designing a system for the development of communication abilities within an engineering context. *Australian Journal of Communication, 27*(1).

Miles, M., & Huberman, A. (1994). *Qualitative Data Analysis: An Expanded Sourcebook* (2nd ed.). Thousand Oaks, California: Sage Publications Inc.

Prados, J. W., Peterson, G. D., & Lattuca, L. R. (2005). Quality Assurance of Engineering Education through Accreditation: The Impact of Engineering Criteria 2000 and Its Global Influence. *Journal of Engineering Education, 94*(1), 165-184.

Ravesteijn, W., de Graaff, E., & Kroesen, O. (2006). Engineering the future: the social necessity of

communicative engineers. *European Journal of Engineering Education, 31*(1), 63-71.
Riemer, M. J. (2002). English and Communication Skills for the Global Engineer. *Global Journal of Engineering Education, 6*(1), 91-100.
Roberts, K., & O'Reilly3rd. (1979). Some correlations of communication roles in organizations. *Academy of Management Journal, 1979 22*(1), 42-57.
Sharma, N., & Patterson, P. G. (1999). The impact of communication effectiveness and service quality on relationship commitment in. *Journal of Services Marketing, 13*(2/3), 151.
Sheath, D., Woolley, H., Cooper, R., Hinks, J., & Aouad, G. (1996). A process for change - the development of a generic design and construction process protocol for the UK construction industry. *Proceedings-inCIT*.
Stevenson, S., Whitmore, S., & Hope, M. (2002). *Strategies for Engineering Communication*.
Stewart, H., Hope, C., & Muhlemann, A. (1998). Professional service quality: A step beyond other services? *Journal of Retailing and Consumer Services, 5*(4), 209-222.
Tan, E. S. E. (2009). *How do Consulting Engineers interact with their Clients?* Unpublished Higher Degree Dissertation, The University of Western Australia, Perth, WA.
Thilmany, J. (2004). New skill sets: a growing area of graduate education mixes the art of management with the technology of engineering. *Mechanical Engineering (ASME), 126,* 12-14.
Trevelyan, J. P. (2007). Technical Coordination in Engineering Practice. *Journal of Engineering Education*. 96(3).
Vinck, D. (Ed.). (2003). *Everyday Engineering: An Ethnography of Design and Innovation*. Boston: MIT Press.
Wager, J. G. W. (1972). Communication Assessment by Taped Role-Play: An Initial Four-Campus Experiment. *Journal of the The Institution of Engineers Australia*, 12-14.
Williams, J. M. (2002). The engineering portfolio: Communication, reflection, and student learning outcomes assessment. *International Journal of Engineering Education*.
Zussman, R. (1985). *Mechanics of the Middle Class: Work and Politics Among American Engineers*. Berkeley: University of California Press.