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RESEARCH ARTICLE

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# Common biases in client involved decision-making in the AEC industry



**Abstract** Understanding of the constitution of client involved decisions is important for future improvements of the processes. Significant decisions in construction projects are reliant on heuristic processes where assumptions are developed from past experience. The paper presents a methodology to collect empirical data in an unstructured manner utilizing participant intuition and experience regarding project level collaboration, a term easily understood by practitioners. Empirical data collected from 6 focus group discussions in Norway and 18 individual interviews in Finland is associated with biases in decision making aimed at bridging the gap of understanding and literature's insufficient coverage. An analytic framework was developed to suit the diverse emergence of concepts to allow application of psychological principles in a structured manner to empirical data. The paper contributes by identifying types of cognitive and motivational biases in client involved decisions. The biases are found to be alleviated by one another depending on the particular application of the decision. Findings suggest that normative beliefs exist developed from past experience and habitual thinking. A number of emerged biases in this domain are alleviated from normative beliefs which are discussed in this paper.

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## 1 Introduction

The role of heuristics and bias in decision making is well-documented in psychology-based literature, making the application of theory to empirical evidence realistic. To allow the application of theory, this paper utilizes the theory of planned behavior (TPB) as described by Ajzen (1985) as a point of departure where behavior is said to be controllable and therefore understandable. This paper contributes to the understanding of the underlying psychological principles by questioning why decisions are made in the way that they are. The approach adopted is non-reductionist, following an open approach bringing about a variety of topics from reality, with only the client aspect described in this paper to ensure concision.

Kerzner (2017) explains that decision making tasks in the AEC industry rely on multidisciplinary and multi-organisational processes that build on continuous feedback of information among participating teams. This means that decisions have an impact on the flow of information and therefore, information latency (IL). The practical significance of bias in client involved decision making is in its effect on inter-team information flow which results in increased IL, therefore negatively impacting the efficiency of multiple teams. Kometa et al. (1996) explain that client attributes influence the successful execution of construction projects. The authors agree with this claim and present a psychological viewpoint to show the biases in decision making, resulting from attributes that are non-optimal or not considered by other teams' members. It is also the authors' view that participating firms should be able to know detailed information about the client, as the client's role in a construction project is more dynamic than in other industries; the client can make or break a project with decisions. Therefore, the gap in literature of insufficient

understanding of client decisions is one that is crucial to fill. The aim of this paper is to apply psychological theories to help understand client involved decisions using empirical data collected from Norway and Finland, two relatively similar industrialised cultures. The point of departure for this study was the focus on collaboration in the collection of empirical data. This presented a wide scope for topics to be introduced purely on the participants perception of the industry from past experience-based knowledge and viewpoints. The novelty in this paper is first, the application of psychological theory relating to biased decision making in this domain. Secondly, the methodology adopts an analytical framework that involves visualization of qualitative data and application of psychological theory of biases in decision making.

### 1.1 Information latency (IL)

IL is commonly used in information technology to describe the delay that information has between the stimulus and response (Murray, 2013). In this context, if we assume that the client is buying information about the building (product) from contractors and/or designers, this involves information transfer between the vendors themselves and the client depending on the changes made in the process which either reduces or increases latency; IL cannot be eliminated but can be reduced. Du et al. (2018) categorise IL into two main classes, technical or cognitive latency. The context involving decision making makes only the cognitive latency relevant in this case, however, the two classes cannot be separated as decisions regarding technical parts are also made which therefore affect the technical latency. Du et al. (2018) define cognitive latency as the time delays between received stimulus and the subsequent response or reaction. Technical latency is the time delay in the data flow from source to its destination. The paper's findings suggest that cognitive latencies emerge from the manner in which decisions are made and can affect the technical latency of information and therefore the technical and cognitive latencies cannot be perceived to be mutually exclusive.

The paper uses IL to explain the effect of critical factors presented on the information flow in a project from the beginning to the defined end. By utilizing IL there is unity in the approach as all factors can be related to how information flows; i.e. the more iterations that are required to generate the final version of information, the more latent the information will be as it requires to flow between participating firms more than the ideal amount.

### 1.2 Heuristics in decision making

Heuristics are mental shortcuts people utilize based on little information that reduces the cognitive burden associated with decision making (Shah and Oppenheimer, 2008). The mental shortcuts introduce biased assumptions that allow decisions to be made (Dietrich, 2010). 'Little information' in this context was connected by the above-presented equivocality, which affects client-based decisions. Montibeller and von Winterfeldt (2015) conducted a review on cognitive and motivational biases in decision-making which result in psychophysical based (PB) and association based (AB) errors. PB errors result from bias relating to incorrect mappings of reality and psychological responses. AB errors result from an automatic mental association with e.g. past experience. Both AB and PB are said to be difficult to correct (Montibeller and von Winterfeldt, 2015).

Biases have been studied and documented in detail by authors such as Tversky and Kahneman (1974) and Gilovich et al. (2002). Cognitive biases are systematic discrepancies between the 'optimal' answer in a judgemental task and the decision makers actual answer. The difference is said to be caused by a normative rule (Winterfeldt and Edwards, 1986) i.e. the way a task is usually or should be done. Motivational biases are those that judgements are influenced by (un)desirability of outcome/choices (Winterfeldt and Edwards, 1986).

Kometa et al. (1996) explain the contextual importance of understanding the biases that affect decision-making and that biases indeed exist. They explain how these biases can come from both internal and external factors. Internal factors include the decision maker's attitude toward risk, organisational structure, experience, and resource availability. Whereas, external factors are, for example, governmental regulations and current market conditions. Many factors are in line with the themes shown in the thematic structure representation in Fig. 1.

## 2 Theoretical underpinning of viewpoint

Ajzen (1985) presents the TPB; understanding how the behavior of people can be changed. This means that the behavior of people is controllable and understandable, forming the motivation and assumptions of theoretical application in this paper. The preceding theory was called the Theory of Reasoned Action which explains that behavior is not completely voluntary nor under control. TPB took this forward by claiming that there is a perceived behavioral control, which means that some aspects are voluntary and others are controlled. TPB brings about three constructs that affect human action:

(1) Behavioral beliefs – beliefs about the consequence of actions;

(2) Normative beliefs – beliefs of what is normal to others;

(3) Control beliefs – beliefs of factors that affect behavior.

The above beliefs are shown to be critical in under-

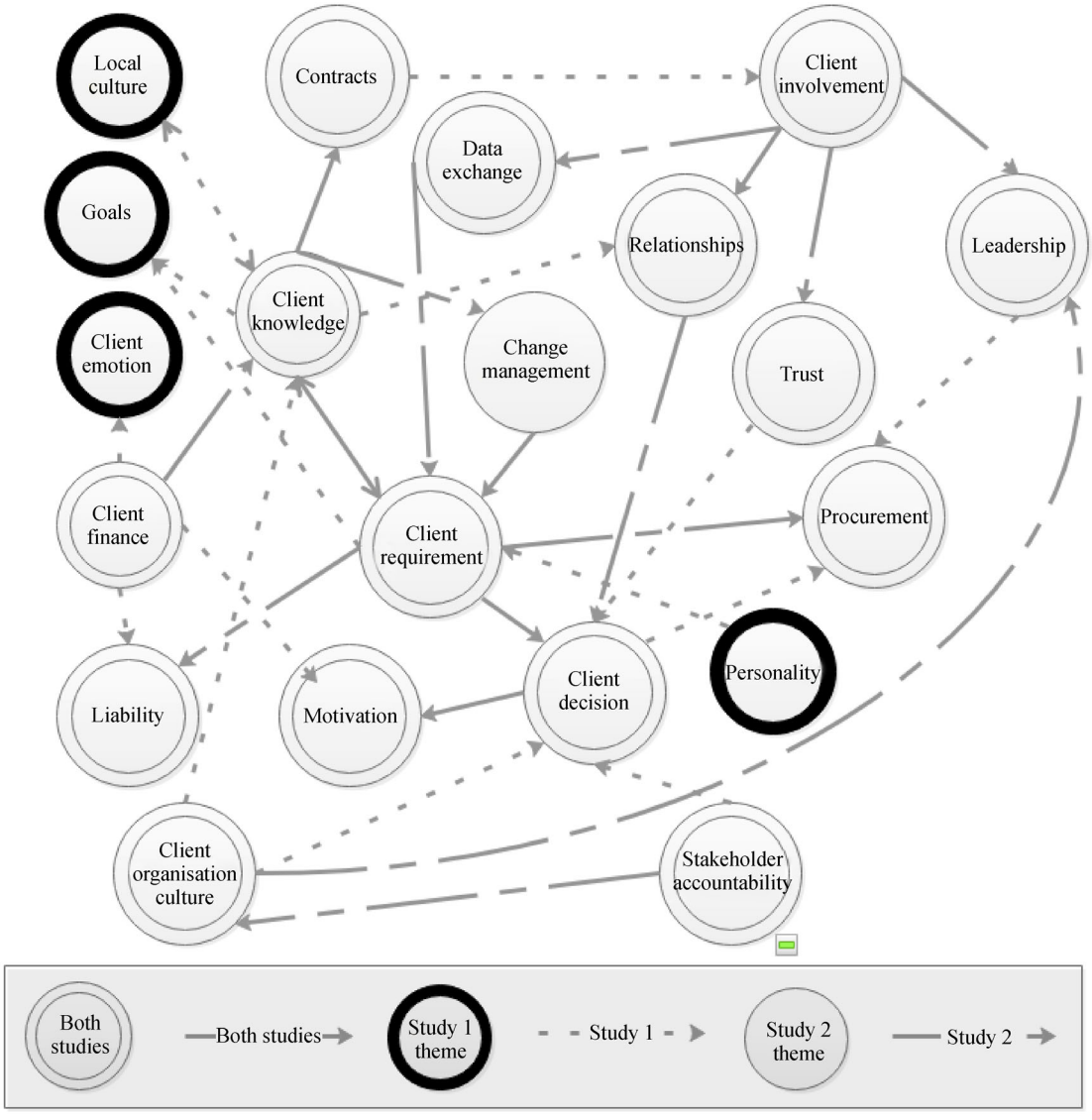


**Fig. 1** Client associated thematic interactions

standing the behavior of people and frequently occur in the discussion section.

Ajzen (2002) investigated the effects of past experiences on later behavior and found evidence of its effect; past experiences impact behavior if measures of intention and behavior of others are compatible. Additionally, the impact of past experience vanishes with strong, well-planned intentions and realistic expectations. The impact of past experience can have an effect on current behavior is the cornerstone of the methodology utilized in this research. The method presented in this paper utilizes empirical evidence derived from the perception that participants have, based on their knowledge and past experience in the industry. Furthermore, past experience was also linked with some of the findings described in this paper.

## 3 Value of the holistic view in the methodology

The data collection in this research was based on an open approach to understanding the factors involved in collaboration focusing on utilizing the participant's view in a holistic manner. Participants were probed to explain problems regarding collaboration using examples from their previous experience. The high complexity of the collaborative environment allowed the consideration of holistic approaches considered by other researchers studying a complex problem; these are presented in this section. Furthermore, the approaches were studied in order to develop the methodology in studying a complex, multi-disciplinary area of knowledge.

The reasons for using holistic approaches as found in the

literature are numerous. Vandenbroeck et al. (2014) explain that unlike reductionist science, where complex interactions are simplified to the sum of constituent parts, holistic methods allow for the use of parameters from different domains of knowledge e.g. the complex social and psychological aspects are inter-linked with the technical and business aspects and are investigated using qualitative research (QR). Researchers should accept that reality is more complicated than can be perceived which allows the opposite effect than is found in natural sciences (Vandenbroeck et al., 2014); the effect is studied to theorise the causes. In this context, participants primarily used examples of past events to present a belief. It is then the researcher's role to theorise the causes of those particular aspects that are presented. Other researchers such as Phelan (2001) explain that 'a lot' can be learnt from 'a little' when developing a methodology that involved questioning phenomena in an holistic approach.

Transdisciplinary sustainability science (TSS) presented by Ruppert-Winkel et al. (2015) reiterates the need for a connection between society and nature by providing a multi-disciplinary approach to solving real world problems consisting of both scientific and non-scientific knowledge. Another similar view is that of soft systems thinking (SST) which is a socio-technical approach to developing models for intervention in real world problems utilizing information gathered from the people involved in the process (Vandenbroeck et al., 2014). Checkland (2000) describes reductionist approaches as giving researchers only a partial picture of reality.

The multi-disciplinary nature of TSS and SST is similar to the nature of the methodology adopted in this study which utilizes empirical data based approaches commonly used in social science and psychology to study a complex problem in the context of management of projects in the construction industry. TSS's high complexity in communication and coordination of areas studied requires significant simplification to draw findings which were shown to be vital as the data collected involved multiple topics such as client involved decision making (discussed in this paper), information exchange and team selection to suit collaboration. Furthermore, there is a need for a transparent, feasible and flexible assessment criterion of data collected depending on the goals of the project (Ruppert-Winkel et al., 2015); decision making biases (well-known in psychology) were related to the empirical evidence. Additionally, empirical evidence was also triangulated as shown in Table 5 giving the reader an idea of the reliability of the claim.

## 4 Methodology

The findings presented in this paper emerge from two studies independently conducted in Finland and Norway. The use of qualitative methodology was arrived at logically as a result of a pilot mixed method study conducted to compare two construction projects. This resulted in low statistical validity in the quantitative part of the study which suggested that a qualitative study was needed to better understand project level collaboration. The rich data are, therefore, best explored through qualitative methodology which is suited to identifying emergent thematic structures using thematic analysis (Braun and Clarke, 2006; see analytical framework for further details). The application of biases in client involved decision making was arrived as a result of the researcher's holistic view of the empirical data and the flexibility of the method. Figure 2 shows the concept of the analytic framework explained in this section. The methodology was presented in the form of a conference paper entitled 'Holistic Methodology to Understand the Complexity of Collaboration in the Construction Process' in the Twelfth European Conference on Product and Process Modeling (ECPPM) and won the best student paper award.

Convenience sampling is a sampling method which means that ease of accessibility, geographical proximity or willingness to participate were the key factors involved in selecting participants (Dörnyei and Griffee, 2010). However, a slight alteration in the application of convenience sampling where the sample was not selected by the researcher but by a gatekeeper (a person that controls the access to people and therefore information in a firm or a number of firms). The Study 1 gatekeeper was an employee of the project management firm who was involved in innovation management. This put the selector at the optimal position to select participants who are involved in the design and construction process. The Study 2 gatekeeper was an academic with a strong interest in the research who arranged focus groups with five firms in Norway with the motivation to cover all the types of firms shown in Table 1. This shows an overview of the studies and highlights the key similarities and differences.

### 4.1 Qualitative research (QR)

QR has been used widely in psychology since the early 1900s (Rieber and Robinson, 2001), however, its application in the construction management domain is relatively new. The application of QR in this domain was conducted using a holistic approach, which enabled emergence of interdisciplinary topics in the interviews and focus groups. By utilizing collaboration as a wide point of departure, participants explain factors from their previous experiences.

Data was collected from two different countries; the studies also had varied participant types as shown in Fig. 2. Study 1 involved interviewing employees involved in the end-to-end construction process in a project management firm. Whereas, Study 2 involved focus groups that were arranged with two contractors, a consultant, a project management firm and a public client. The varying nature of

**Table 1** Overview of studies

| Location | Study 1: Finland | Study 2: Norway |
|---|---|---|
| Level of digital technology commonly used | Level 2 to 3 | Level 2 to 3 |
| Approach | End to end, one firm perspective | End to end perspective multiple firms |
| Duration | 5 days | 5 days |
| Method | | |
| Focus groups | Nil | 5 (14 participants) |
| Semi structures interviews | 18 individual interviews | Nil |
| Qualitative analysis | Thematic analysis | |
| Participant classification | End-to-end project management (design and production managers) | 2 contractors, 1 project management, 1 public client, 1 consultant, 1 industry organisation |

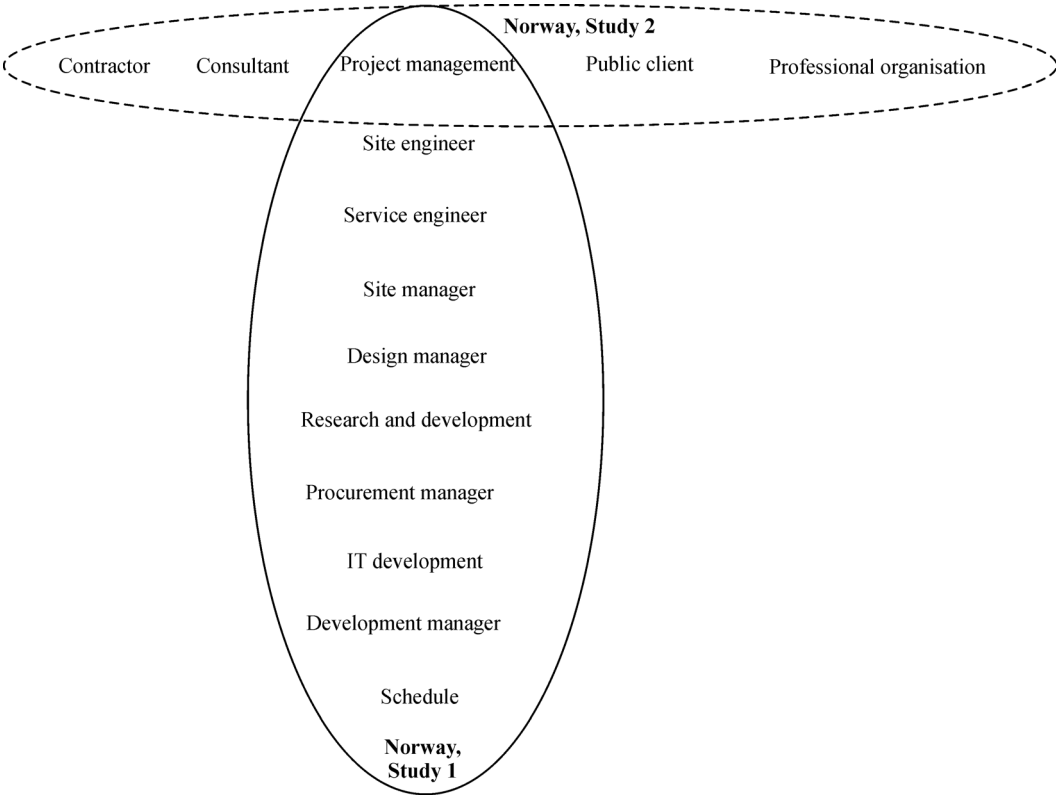


**Fig. 2** Overview of participants

the participants from the two different studies enables strengthened triangulation of findings resulting from similarities in geography and disciplinary cultures. Additionally, the difference in samples and manner of data collection also enables the researcher to have more coverage that allows understanding of any hidden factors to one study, which became more transparent in the other study.

The gatekeeper's role in acting as the link to build relationships for the researcher makes this not a purely convenience based sampling approach. The relationship based convenience sampling allowed for easier access to participants and provided a good introduction of the participant's role in the business ahead of data collection; allowing the researcher to design questions more likely to be answered with respect to the participants view. For example, if the participant was a production manager working on site, questions regarding design collaboration were limited but not discounted as there is transfer of information and knowledge between design and production.

The open approach to interviews and focus groups is in line with the previously reviewed literature from TSS and SST in order to gain a distinct non-reductionist view of reality. The researcher's role was to ask the participant(s) for explanations using examples of what constrains teams

from collaborating efficiently. Topics were then driven by the participant, where the researcher would probe any topics that are not well understood for further explanation. This open approach is the reason that this method is branded as a holistic method; the topics are not selected by the researcher but come from the participants themselves. The researcher merely puts the questions into the mind of the participant seeking pure perception based on past experience and industry-based knowledge.

### 4.2 Participants

All participants in both studies were involved in full time roles in a firm associated with delivery of construction projects. Table 2 shows a description of the role and number of participants in Study 1. Table 3 shows a description of each firm involved in Study 2 and the role of their participants.

### 4.3 Analytic framework

Table 4 shows the analytic tasks used, both empirically and theoretically, to derive findings discussed in this paper. Figure 3 shows an overview of the analysis of empirical data. The separation of empirical and theoretical analysis was beneficial from the linguistics point of view; interviews/focus groups used simplistic language avoiding incomprehensible psychological terminology to practitioners. The empirical analysis was conducted once all the data was transcribed in order to ensure higher levels of immersion as required by the first step of empirical analysis; structuring the information (Table 4, 1a) under codes and themes in thematic analysis (Braun and Clarke, 2006). Once the themes and codes were representative of the data collected, to give a holistic view by mapping interactions, a thematic structure as shown in Fig. 1 was created (Table 4, 1b). These two steps formed the tools the researcher used to investigate trends with respect to topics (Table 4, 1c) such as client decision making which this paper is focusing on to generate empirical factors as shown in Table 5.

Once empirical factors were developed, keywords were generated to conduct a literature review (Table 4, 2a) on the theoretical aspects that could explain the trends found. In this context keywords such as ‘heuristics’, ‘bias’, ‘decision making’, ‘client risk’ etc. were associated. Each empirical factor (Table 4, 1c) was then utilized to find relevant psychological theories (Table 4, 2b) to help explain the emergence of bias in client involved decision making.

### 4.4 Methodological limitations

Gatekeeper related limitations exist in the methodology. The possibility that the Study 1 gatekeeper may have selected participants in a biased manner, furthermore, the firm was known to be one of the best firms in the industry for project management. The Study 2 gatekeeper brought in firms interested in research, which may not be representative of the average firm in the industry.

Clients vary significantly, therefore findings cannot be generalized to all clients, however, biases found, that are highly triangulated, can be assumed to be common in the industry.

The method lacks statistical validity in a cohesive quantitative manner, however, ‘soft’ triangulation was utilized due to factors requiring interpretation by the

**Table 2** Study 1 participant role description

| Role | Frequency | Description of role |
|---|---|---|
| Site engineer | 2 | Works with the site manager on site in being the lead team on site. Assists in managing the subcontractors and daily operations on site. Involved in motivating the subcontractors and dealing with design changes. Partially involved in procurement of sub-contractors |
| Service engineer | 1 | Pipe renovations from start to finish, design to production. Direct link to client and managing the designs and subcontractors |
| Site manager | 4 | The leader of production on site. Assisted by site engineers and holds a role to manage subcontractors and resources used on site. Also involved on site originating design changes |
| Design manager | 3 | The leader of the design teams; controls collaboration between design teams by the use of digital tools and big room discussions. Also involved in some circumstances in the procurement of design teams. Involved in 3 to 4 projects at the same time |
| IT development | 2 | A strategic organisational role involving process management to ensure that projects follow the strategy of the firm. Developing the process of construction continuously |
| Schedule Management | 2 | Managing the schedules of projects, at least 10 projects at a time. Developing a master schedule and then adding more detail as the process evolves |
| Procurement | 1 | Selection and controlling subcontractors. Development of subcontractor contracts |
| Development Manager | 2 | Manages developments that the company partially have a stake in from beginning to end mainly in residential developments |
| Research and Development | 1 | Involved in developing innovative ideas to improve productivity in the firm. Highly involved in developing an organization wide learning system |

**Table 3** Description of firms and participants in Study 2

| Category of firm | Number of participants | Description of firm and participants |
|---|---|---|
| Contractor | 2 | Involved in building and civil projects. Primarily running projects in Norway and have begun to work in Sweden. Privately owned firm and approximately 65% of shares are owned by employees. Participants are innovation managers in the firm |
| Contractor | 3 | Involved in civil and building construction in Norway. One of the largest contractors in Norway regarding building construction. Participants involved were involved in BIM driven innovation in teaching staff and developing process management |
| Design and Management Firm | 4 | Primarily a design firm who has the ability to manage the end-to-end construction process. One of Norway's top six design firms. Participants involved were an innovation manager, project design manager and a BIM coordinator/manager |
| Public Client | 2 | A Norwegian government funded client who is involved in the development, management and facilities management of buildings. The participants were involved at the strategic level in developing the use of innovative technologies e.g. BIM and developing client requirements |
| Professional Organisation | 2 | Participants were involved in the national development of standards and innovation development |
| Project Management Firm | 3 | A firm that controls the end-to-end process of construction projects similar to the firm in Study 1. The participants were involved in developing organisational strategies and innovations |

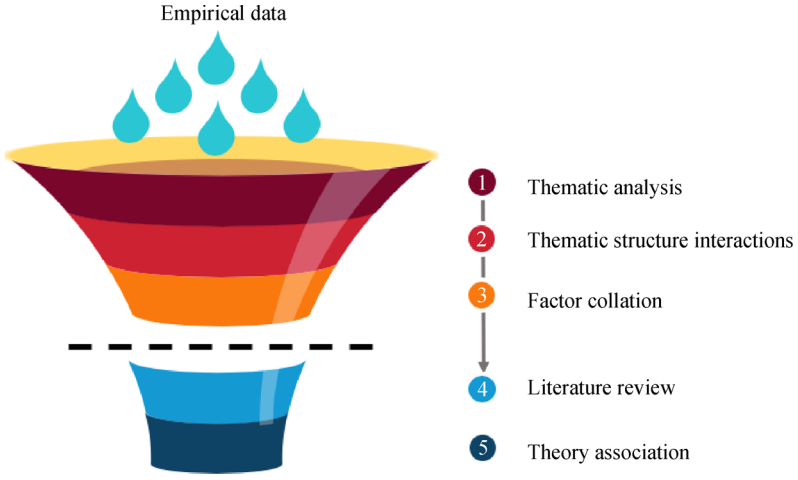


**Fig. 3** Analysis of empirical data overview

**Table 4** Summary of analytic framework

| | | | | Task | Method |
|---|---|---|---|---|---|
| 1 | Empirical Analysis | Critical factor emergence from perception of researchers and participants | a | Thematic analysis | A commonly used methodology in psychology to sort information collected qualitatively in a widely accepted manner |
| | | | b | Thematic structure interactions | Interactions between themes are plotted in network diagrams which represents a visual tool that the researcher utilizes to understand the underlying processes |
| | | | c | Collation of critical factors | Critical factors associated with a particular topic are selected based on empirical evidence from thematic analysis |
| 2 | Theoretical Analysis | Association of bias from psychology | a | Literature review | Keywords emerged from thematic analysis and the researcher's holistic understanding driven by data collected was used to associate psychological theories with bias in decision making |
| | | | b | Association of critical factors with psychological theories | Understanding of biases are applied in client driven decisions by relating empirical evidence from critical factors to generalized definitions of phenomena found in psychology |

researcher.

Differences in approach of Studies 1 and 2 bring strength in triangulation and allows for exploration of greater perspectives; however, it would be biased to conclude that the emergence of psychological theory discussed in this paper is representative of the average client in both industries but shows its existence in reality.

## 5 Empirical findings

Table 5 shows a summary of the empirical factors that emerged in literature referred to in the sections below by the denoted code e.g. EC1. A success and failure characteristic is explained for each factor to help avoid ambiguity in the definition of the factor as the factors themselves may come across as generic. The level of controllability from the viewpoint of a project manager at the project level was also presented. A low controllability shows that the project manager cannot influence the aspects that affect client decision making, medium controllability means that the project manager has some influence and high controllability means that the project manager can control the aspect. The effect on IL gives the reader an idea of how exchange of information is impacted negatively. Possible reasoning explains the evidence for each empirical factor. The strength of triangulation is also presented to give the reader an idea of the reliability based on the number of times a factor was mentioned or referred to. A highly triangulated factor was defined as one that emerged in more than one interview/focus group in both studies; medium emerged in more than one interview/focus group but only in one study and a low rating was given to a factor that only emerged in one interview/focus group in one study. Finally, literary evidence is provided for each empirical factor, which is explained in the discussion section. The empirical evidence summarized in Table 5 was triangulated and considered as support for understanding client involved decision making. The following section presents the existing knowledge to laying this foundation.

Human relationships are said to be critical and trust and respect are found to be the determining factors (Briscoe et al., 2004; Che Ibrahim et al., 2015) and trust has been illustrated as relevant or organisational function and success in other domains(Wheatcroft et al., 2012). This explains the deduction from empirical data which shows that client involvement in selecting teams is critical (Table 5, EC7); participants explain the need for transparency and trust in the lead management to procure teams. Participants present examples of projects where the client did not consult the leader before procurement, which hampered collaboration because of the lack of trust development and team cohesion. Further to this, participants claim that the client does not have the experience and knowledge to select teams on their own. On the other hand, project management firms tend to know from experience which firms can collaborate more efficiently.

The technical knowledge of the client (Table 5, EC1) was said to be lacking by a number of participants and explained this in that they do not have the skills to facilitate efficient technical dialog. Engström and Hedgren (2012) found that heuristics developed from conventional buildings was being utilized to bridge the gap of the lack of technical knowledge brought about by prefabricated buildings. Hedgren and Stehn (2014) relate equivocality to decision making. Equivocality is defined as the human problem of managing multiple meanings and conflicting interpretations (Weick, 1979). Numerous studies (e.g., see Neill and Rose, 2007; Levander et al., 2011; Rachel Dinur, 2011) associate equivocality with decision situations and innovation. In this context, decision makers (clients) may not know what information to search for or may not know how to interpret information. Interpretation of information dimension of equivocality results in testing the knowledge of a client, i.e. whether the client representative can use BIM and comprehend the various parts of the model. Furthermore, the presence of equivocality shows that information can be perceived as unanalysable and therefore heuristics is utilized to consider soft information (heuristics) which is used to construct an interpretation (Daft and Weick, 1984).

The client's perception of the industry culture was related to the claim that the decision maker's heuristics make subjective judgement with respect to the status quo practice (Hedgren and Stehn, 2014); e.g., a number of participants explain the influence of the client's perception that firms are driven by solely financial goals.

The importance of basic psychological processes defining judgement and choice is highlighted by the decision theory by Einhorn and Hogarth (1981). These processes were split into four categories: information acquisition, information evaluation, action/choice and feedback/learning. These processes can be perceived as an iterative loop where value is gained from learning and applied to the following tasks. Applying this to organisational culture in relation to the claim that 'organisational hierarchy is killing collaboration (Table 5, EC3)' can be seen that there is a lack of feedback/learning from project to project in the ways that the client firm changes. For example, some public client representatives were claimed to push relatively easy decisions up the hierarchy, showing the highly perceived personal risk to making decisions. This was perceived as very inefficient by many participants resulting in a loss of motivation and continuity in team performance. Simon (1965) explains how a decentralised decision making process in firms brings about relying more on the heuristics of the individual which can alleviate the propensity to prefer a reduced risk to a potential gain (Kahneman and Tversky, 1979). As suggested by the empirical evidence, if there is personal liability inflicted both formally or informally, this can impact on decision

**Table 5** Empirical findings

| Empirical critical factor | Success characteristic | Control-lability | Failure characteristic | Effect on information latency (IL) | Possible reasoning | How it can be controlled | Strength of triangulation | Key literature associated |
|---|---|---|---|---|---|---|---|---|
| Client Technical Knowledge (EC1) | Client Representative is able to understand information in the manner that it is produced | Medium | Client Representative requires a different form of information to enable complete understanding | Equivocality influencing client driven decisions negatively. If the client requires a simplified form of information, this adds more pressure on the teams; higher technical latency | Not incentivised and lack of awareness of importance in client firms | The involvement of an independent consultant bridging the gap of technical competency | High | Hedgren and Stehn (2014); Engström and Hedgren (2012); Neill and Rose (2007); Rachel Dinur (2011); Levander et al. (2011);Daft and Weick (1984) |
| Client Perception of Industry Culture (EC2) | Client does not think the players are solely driven by individual profits | Low | Client decision is affected based on assumptions such as firms are driven by capitalistic and opportunistic goals which creates lack of trust between teams and client | Negative influence on client decision making driven by heuristic based assumptions stemming from local industrial culture or past experience. Poor decision-making results in higher probability of technical latency | Long-term traditional values running culturally in client firms; internal policies of client firms which are set to make the Client Representative think about cost control in a fixed manner resulting in lack of client trust | Leadership strategies to make openness of finance critical in the contract, develop trust from the beginning of the project; rewards to teams that reduce cost drastically | Medium | Boukendour (2007); Van Duren and Voordijk (2015) |
| Hierarchy of Client Organisation Culture (EC3) | Hierarchy in the client organization does not influence Client Representative; sufficient freedom to make decisions | Low | Long process in decision making as decisions are passed up the hierarchy | Judgement/response selection delay as Decision making is slowed down, therefore creating a breakage in the flow of information | The Client Representative is contracted to the client organization in a way that inflicts personal liability, Client Representative is in a position where faults can be traced back and made public | Awareness to client organisations | High | Schneeweiß (1995); Kometa et al. (1996); Simon (1965) |

(*Continued*)

| Empirical critical factor | Success characteristic | Control-lability | Failure characteristic | Effect on information latency (IL) | Possible reasoning | How it can be controlled | Strength of triangulation | Key literature associated |
|---|---|---|---|---|---|---|---|---|
| Client involvement in contract development (EC4) | Trusting the project management enough to give them leverage over teams | Medium | Client wants to be in the position of power, which puts the project management in a decentralised role | When the leader has lower leverage to other teams, teams are prone to deliver information not on time or lacking in quality | If the contracts are direct to the client, there is risk of the client not having sufficient knowledge to make decisions. Financial leverage to the project management firm allows for control over the other teams | Open dialog between the client and the project management when developing contracts early in the project progress | Medium | Che Ibrahim et al. (2015) |
| Client perception of own role (EC5) | Client understands that there is need for high involvement and interaction with teams | Medium | Client only considerate to financial issues | If the client is not involved optimally, cognitive latency can emerge from delayed/poor decision making | Client's involvement is vital to the team's motivation and their own understanding of processes that teams utilize to interoperate | Project management to raise awareness to the client of the need for consistent involvement throughout the project | High | Loosemore and Richard (2015); Thompson (1991); Rajakallio et al. (2017) |
| Client knowledge of own needs (EC6) | Client's needs do not change through the process of design and construction | Low | Client needs constantly evolved putting pressure on teams to provide solutions systemically, bringing uncertainty of extra work claims in accordance to the contract | More information flow due to extra work, repetition of tasks reduces motivation, therefore higher probability of latent information | The client needs affect the client requirements that teams are developing a product for, therefore, if the requirements consistently change, this brings inefficiency | Client to use forms of virtual reality to understand what is needed | High | Loosemore and Richard (2015); Kometa et al. (1996) |
| Clients influence on team selection (EC7) | Client oversees team selection in a transparent manner with the project management | Medium | Client selects teams without consulting project management | The non-optimal selection of teams can bring about lacking trust and motivation, teams do not have the skills and characteristics to interoperate | Team selection is critical in ensuring that teams can interoperate efficiently with the skills, personality and experience they have | Client to trust the project management to enable a open procurement strategy not only based on skills but previous experiences | High | Che Ibrahim et al. (2015); Briscoe et al. (2004); De Araújo et al. (2017); Kometa et al. (1996); Loosemore and Richard (2015) |

(*Continued*)

| Empirical critical factor | Success characteristic | Control-lability | Failure characteristic | Effect on information latency (IL) | Possible reasoning | How it can be controlled | Strength of triangulation | Key literature associated |
|---|---|---|---|---|---|---|---|---|
| Client Financial Stability and Flexibility (EC8) | Client is able to finance major changes to the budget mainly due to changing client requirements | Low | Client changes requirements with insufficient financial flexibility | Lack of motivation as the finance is not flexible enough to take on the changes requested; susceptibility to IL | The lack of financial flexibility can bring about less motivation to teams when the client requirements change as they question whether they can be paid as agreed. Extra works claims can be rejected | Leadership to plan the financial part of the project with more contingency if client needs will change and if the client is less financially flexible | Medium | Kometa et al. (1996) |
| Client Attitude (EC9) | A more consulting attitude | Low | An enforcing attitude | A client with a consulting attitude can utilize teams to make suitable decisions to reduce risk of IL | The client's attitude makes the consultants fear to be open about innovative solutions | Awareness to client organisations | High | Kometa et al. (1996) |
| Client perception of early investment on processes (EC10) | Client accepts early investment on processes understanding that information delivery can be streamlined for future benefit in the project | Low | Client does not see the value in early investment on processes | More streamlined processes allows for faster generation of information and therefore less technical latency | Processes like scripting of repetitive tasks can be done to reduce the time taken and human resources allocated | Client to improve understanding of technical aspects in the end to end construction process | Low | Hedgren and Stehn (2014); Simon (1965); Collins et al. (2017); Luo et al. (2016); Chang and Chiu (2005); Loosemore and Richard (2015); Briscoe et al. (2004); Pesämaa et al. (2018) |
| Client's criteria for success (EC11) | Client promotes collaboration as part of their criteria for successful projects | Low | Client focuses on financial criteria for success | Positive collaboration can improve information flow in numeral ways both cognitively and technically, enabled by increased openness | Client demands are treated seriously by teams employed and therefore would make collaboration important | Awareness to client organisations | Medium | Karen and Le (2015); Babaeian Jelodar et al. (2016); Pesämaa et al. (2018); Kometa et al. (1996); Loosemore and Richard (2015); Briscoe et al. (2004) |

making negatively. Further empirical evidence suggests that the client's perception on early investment on processes (Table 5, EC10) is critical, as the innovation that requires early investments is perceived as risky. Kahneman and Tversky (1979) claim of preference to reduced risk rather than potential gain affects the client's decision, empirical evidence suggests that if the client trusts the lead management firm, this reduces the preferential perception. Furthermore, Briscoe et al. (2004) also explain that change needs to be driven by the client to make processes more efficient. However, empirical data shows that many clients lack the exposure and knowledge to manage innovation and therefore depend on the relationship with the leadership and teams.

Kometa et al. (1996) studied the client generated risks to project consultants and presented client attributes that affect the performance of the consultant teams. The characteristics regarding the organisational structure and communication channels of the client are acknowledged to be important (Table 5, EC3). The client's skill in organizing the project team was related to their influence on how teams are selected (Table 5, EC7), how teams were allocated with responsibility and coordination. The manner in which the client manages teams was described as their attitude (Table 5, EC9) toward teams; participants claimed that a consulting client attitude rather than an enforcing attitude would result in better collaboration and cooperation. Additionally, Kometa et al. (1996) attributed the client's project priorities which is related to the clients criteria for success (Table 5, EC11).

Kometa et al. (1996) and Zolghadri et al. (2011) explain the impact of the client's financial health on the project (Table 5, EC8) and explain that the choice of the supply chain has a direct impact on the client financial health.

Rajakallio et al. (2017) explain that construction clients are recommended to follow a perceived standard industry logic known as normative beliefs in psychology. Pesämaa et al. (2018) expand, implying that known sets of solutions and processes are routinely applied on construction projects, presenting a critical factor; the client's perception of their own role (Table 5, EC5) which depends on their normative beliefs.

Karen and Le (2015) explain the need for requiring efficient collaborations as one of the criteria for success (Table 5, EC11), as there is loss in cost and time from difference in understanding of outcomes (Senescu et al., 2012). Additionally, Babaeian Jelodar et al. (2016) explain that the priorities of firms and clients differ at the project level meaning that the criteria for success (Table 5, EC11) is not well defined and supported contractually.

Projects are found to lack success when poorly coordinated (Pesämaa et al., 2018) making early investment on processes critical (Table 5, EC10). Furthermore, Chang and Chiu (2005) suggest that poor process performance in projects could be due to the lack of its players joint understandings showing the need to collaborate and exchange knowledge about the process.

Briscoe et al. (2004) studied the extent to which the client can increase the integration of the construction supply chain and finds that, although the client is influenced by environmental variables, the client's role in selecting teams (Table 5, EC7) and the desire of the client to develop relationships (Table 5, EC11) is critically important.

Che Ibrahim et al. (2015) agree with the empirical claim that the client to some extent has control over which contractual agreement to use on the project (Table 5, EC4).

Thompson (1991) explains that the role of the client (Table 5, EC5) at the project level is crucial where there is need to intervene at development and implementation stages of the design and construction process.

Loosemore and Richard (2015) conducted a review of literature and found three attributes to a successful client; clarity of needs (Table 5, EC6), active involvement in the project (Table 5, EC5, EC11) and understanding that the lowest bid is not necessarily the best option (Table 5, EC7). Additionally, Loosemore and Richard (2015) explain that there is need to have an innovation strategy involving the client, which would streamline processes and requires early investment (Table 5, EC10).

Van Duren and Voordijk (2015) found that opportunism (self-interest) was common in the construction industry but appears to be on the decline. Combining the existence of opportunism and the previously mentioned heuristics and normative beliefs that are developed from the past experiences, empirical evidence suggests that some clients base decisions on the belief that opportunism is still common and a viable risk (Table 5, EC2). Boukendour (2007) explains the negative effect of opportunism on collaboration and cooperation. Empirical evidence allows expansion based on this claim; the presence of opportunism in the past experience of a client can bring assumptions that making innovative activities are risky (Table 5, EC10) alleviated due to the lack of technical knowledge (Table 5, EC1). Therefore, it is possible that an opportunity to improve is neglected and decision is made to reduce the risk (Kahneman and Tversky, 1979) as a result of this normative belief.

## 6 Discussion

Context is required to be able to understand the contributions of this paper; it is not claimed that all clients make decisions based on the cognitive and motivational biases found in this paper. Figure 4 shows a conceptual overview of the data findings bringing together the various topics associated with biases in decision making.

Normative beliefs are identified and are shown as reasoning for the manner by which decisions are made. The bias decisions affect trust and collaboration at the project level, which are claimed to be critical in relation to

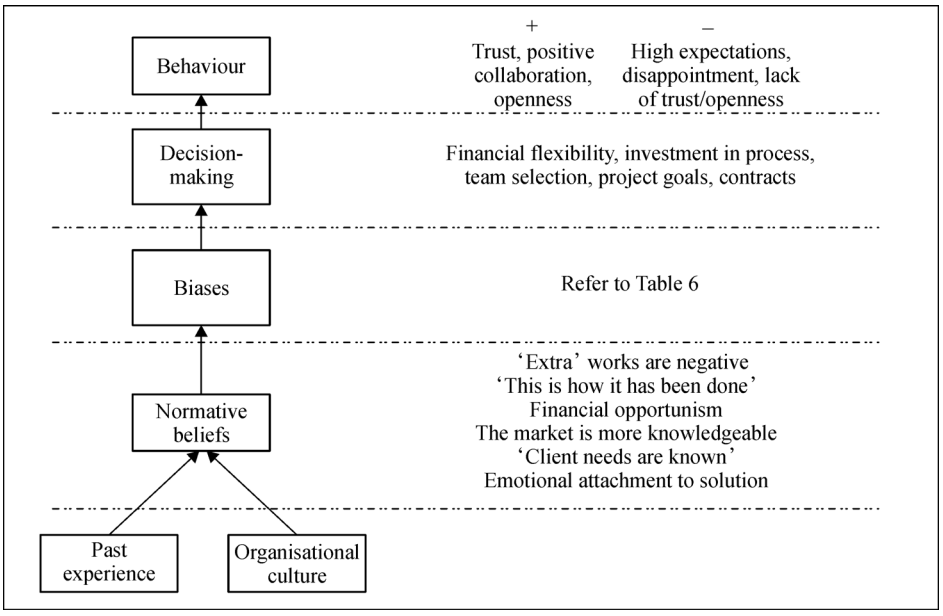


**Fig. 4** Conceptual overview of findings and existing knowledge

project success.

When considering the outcome of this paper, it is important to note that clients vary significantly (Manley, 2006) which means that some biases may be more prone to some clients than others. The existence of these biases is highlighted and defended in this section in order to assist practitioners by providing understanding to improve policy making and development of procedures that assist decision makers. References to empirical factors in Table 5 are denoted by the code e.g. EC1 and factors from Table 6 are denoted by e.g., O1 as indicated in the first column of each table.

**Table 6** Association of bias with observed problem from empirical evidence

| Observed problem | Examples of emersion | Name of biases associated | |
|---|---|---|---|
| | | Psychophysical based errors | Association based errors |
| O1: The definition of client needs (EC6) | The clients do not know what they want to achieve so it is hard to set goals | Gain-loss | Myopic problem representation<br>Omission of important variables |
| O2: Lack of client knowledge (EC1, EC7, EC10) | Not enough skill in the clients to move to value-based procurement | Gain-loss | Overconfidence<br>Myopic problem representation<br>Omission of important variables<br>Confirmation |
| O3: Perception of teams having strong financial goals (EC2) | Clients feel that there is catch but you cannot see it, they think the building industry is all about making money out of the client | Gain-loss | Availability/Ease of recall |
| O4: Openness about finance (EC8) | Blind spot in extra work, it can be looked as a modification or not, it brings arguments | Anchoring | Confirmation<br>Overconfidence |
| O5: Inefficient financial model to foster collaboration (EC4, EC6) | Penalties for scheduling, we are trying to adopt reward based system | Anchoring | Overconfidence |
| O6: Lack of flexibility in client needs (EC6) | The BIM manual that the client provides is high in detail, no-one uses it, they are too detailed | Equalising bias | Myopic problem representation |
| O7: Lack of use of new contractual models (EC4) | Reluctance from clients to use new contracts | Gain-loss | |
| O8: Enforcing client attitude (EC2, EC5, EC7, EC9, EC11) | The client didn't try to promote and create a cooperative environment and made controlling decisions based on a fixed budget which made teams stuck | | Confirmation |
| O9: Personal liability (EC3) | Counting every cent as the decision maker is personally liable and not made to feel protected | | Affect influenced |

### 6.1 Psychophysical based cognitive biases

The effect of gain-loss bias is when a decision is made based on a positive or negative connotation, brought about by lack of certainty in information to show whether the decision would result in a positive/negative attribute to the cause (Tversky and Kahneman, 1981; Levin et al., 1998). The gain-loss bias emerges when participants explain that some clients do not want to follow the new contractual models such as integrated project delivery (IPD) based on the possible negative connotation brought about by the cultural perception of firms being driven by solely financial goals (Table 5, EC2) resulting in lack of client-based trust. Some participants mentioned the need to change this mindset as clients feel that 'there is a catch' even if teams appear to be open about finances. Gain-loss bias applies as there is a lack of certainty or information (equivocality) which makes the client base decisions on heuristics rather than real time information. Furthermore, partially due to the same negative connotation some clients choose their own firms (Table 5, EC4), however, more often than not they end up spending more on the project. For example, the client chooses its own contractor more often than not based on price (discouraged by many authors such as Wong et al. (2000)) but does not consider important factors such as whether the contractor and designers are going to be able to collaborate efficiently or whether the firm is capable to deliver the service. Participants from Study 1 explain that sometimes the teams are contracted before the project management firm making modifications bring about arguments over finance resulting in a non-optimal solution for clients. Additionally (partially due to the above negative connotation), participants from a project management firm explain that some clients that do not take a leadership role on the project position themselves at the center of contracts bringing about loss of power to the employed project management firm (Table 5, EC4); the leader loses leverage which results in less financial control creating inefficiency.

The anchoring bias occurs when the estimation of a numerical value is based on an initial value, then adjusted insufficiently to provide the final answer (Tversky and Kahneman, 1974). At the project level, negotiations based on extra works are ones that clients and lead management engage in as changes are made. Participants explain the lack of certainty in defining what consists of extra works present in the contract bringing about the need for negotiation (Table 6, O5). Furthermore, these extra works are perceived as a source of financial penalty to a team or the client. It can be argued that the perception is based on normative beliefs as this is seen to be normal. However, participants explain that there is need for rewards for extra work to encourage development of optimal solutions and the use of innovative processes. However, normative beliefs seem to hold back this possibility in many projects.

The anchoring bias inflicted by the firm presenting an extra work claim depends on the relationship with the client and the manner in which the client reacts. Empirical evidence suggests that for a budget-strict and non-trusting client, firms could make use of the extra works claim to gain for the losses earlier made utilizing the anchoring bias. Additionally (in the traditional contract), since the needs of the clients are commonly relatively uncertain at the beginning of a project, the anchors used in financial estimation of objects that depend on the needs are empirically suggested to be incorrect (Table 6, O4/O5) as teams follow the normative belief that extra works claims result in a risk to lose profits. This results in a higher uncertainty to the firm in the tender process; an example of the overconfidence bias presented below.

Equalising bias is when decision makers allocate similar weights to objectives, probabilities or events (Fox et al., 2005; Fox and Clemen, 2005; Jacobi and Hobbs, 2007). A public client with numerous construction projects (Study 2) defines the manner in which information should be shared between teams. Contractors explain that the instructions to share information are too specific showing that the level of importance of each part was similarly weighted; everything was deemed as important. Furthermore, when a client was questioned about the manner in which their needs are defined, the participant admitted that at times needs are not clear as clients themselves do not know what they want (Table 6, O1; Table 5, EC6). Alleviating the bias is the normative belief that the firms providing a service to the client are more advanced and therefore capable (confirmation bias); bringing about a gap between what the definition of client needs and industry-based capability to provide for needs. The lack of clarity of needs brings about the assumption that needs are all important (similarly weighted) making the equalising bias cause further alleviation of this hidden problem.

### 6.2 Association based cognitive biases

The availability bias occurs when the probability of an event is easily recalled or overstated (Tversky and Kahneman, 1973; Bazerman and Moore, 2008). An example of empirical evidence associated with this bias is the common perception of firm financial goals in the industry as explained under gain-loss bias. This normative belief comes about as a result of past experience of the client and creates inefficiency by impacting decision making. Since this common perception affects how the client trusts the teams on the project, this was said to bring about less openness and a negative collaborative environment was explained to be more probable. Furthermore, on a positive note, a participant explained that an experienced client firm began utilizing IPD, which resulted in a better project and therefore, the client began to demand IPD in future projects; overstated as in the availability bias. This relates to the prediction of Ajzen (2002); the impact of past

experience can vanish with strong, well planned intentions and realistic expectations.

Myopic problem representation bias is said to occur when an oversimplified problem representation is adopted which is based on an incomplete mental model (Legrenzi et al., 1993, Legrenzi and Girotto, 1996; Payne et al., 1999). In this context, empirical evidence suggests that the client oversimplifies their needs due to the lack of knowledge (Table 6, O2; Table 5, EC1, EC6) and experience. This is explained to be more evident when using BIM in facilities management as the manner in which building parts are modeled needs to reflect their use. Data suggests that the mental structures utilized in project delivery are done in accordance to the roles of firms in design and contracting; there is no need to consider the entire lifecycle of the building, there is no financial motive. Therefore, decisions are made based on a gap between what is truly needed to suit the operations of the building and the solution to the client. Alleviating this is the lack of client knowledge bringing about the lack of foresight to make this critical in the beginning of the project. Additionally, one participant explained the paradox in some client needs where 'definition of needs is to be done before knowing the realistic needs in the particular context' showing that there is an ever changing mental model which results in oversimplification and therefore a non-optimal definition of needs.

Omission of important variable bias occurs when an important variable is overlooked (Jargowsky, 2005). This could be as a result of the myopic problem representation bias where simplification results in omission. Empirical evidence similar to the above presented can be used to back the application of the bias as this results from the lack of client knowledge and therefore the insufficient coverage of needs (Table 6, O1; Table 5, EC6) resulting in alleviation of consequences.

Overconfidence bias occurs when decision makers provide estimates for a given parameter that are over-estimated or too precise (Lichtenstein and Fischhoff, 1977, Moore and Healy, 2008). A public client who delegates the manner in which BIM is used produces a BIM manual. Participants explain how this manual is too technically detailed and specific therefore bringing about overconfidence bias in the form of over-precision. Furthermore, when budgeting, strict financial management was said to more likely result in poor project success. When questioned the reasoning for stricter financial management, some participants believed that it was because the client overestimated his/her own ability in planning the budget (Table 5, EC8) commonly perceived as a non-dynamic process resulting in disappointment when changes are inevitably made. This also involved lack of trust of firms (from the common financial belief presented in gain loss bias) where clients tended to assume that the stricter they were the more they would save (gain loss bias). Furthermore, the client tends to overestimate the contract's ability in defining extra works; participants explain that there is uncertainty in what constitutes to be an extra work that is claimable which results in disputes and negotiation, which tests trust between the client and teams.

### 6.3 Association based motivational biases

Confirmation bias occurs when there is a desire to confirm one's belief which usually occurs as unconscious selectivity in how evidence is used (Nickerson, 1998). From a focus group, an example with a public client revealed that the confirmation bias may be present in some clients. A public project with a fixed price contract was managed strictly (overconfidence bias) which resulted in the project going over budget and over time resulting in it being halted. During this time, the client was said to be not supporting collaborative working methods and was not open to change, participants believed that this may have been due to the normative belief that the firms want to make higher profits (Table 6, O3) and the perception that this way of working was normal in the industry and has been done successfully in the past. This resulted in a lack of trust between the client and teams which forced the client to halt the project. A total shift resulting from new client representation which supported collaboration and cooperation with less focus and more flexibility in the budget (Table 5, EC8; Table 6, O4) improved dramatically the likeliness for project success. Furthermore, a consultant explained that clients have a habit of not allowing changes in the budget early in the process of design and this results in later changes which end up costing more (Table 5, EC10; Table 6, O2). When questioned why the clients behave in this manner, the confirmation bias was brought about as various normative/behavioral beliefs (such as perceiving the teams have solely financial goals and enough knowledge to provide accurate overall financial estimations) were explained, resulting in lack of trust between client and teams.

A public client explained that there is a common normative belief in their organization that the firms in the market are ahead of the client in terms of capability and understanding due to the lack of knowledge about the market (Table 6, O2). This is an example of a belief that brings about unconscious assumptions (e.g., high expectations) when decisions are made by changing the perception of evidence provided; confirmation bias.

A representative from a project management firm explained that when the client does not set up contracts in a manner that gives the project management firm enough control over other firms by giving the leader enough leverage, this can result in higher costs. The client puts itself in a position of financial control based on the belief that they would be more in control of the project (Table 6, O8), although the client may not have sufficient knowledge and involvement to be in that position (Table 6, O2). Based on this belief of false control, the participant explained that

the lead management firm ended up being held accountable as the client used evidence based on normative beliefs, assuming the firms could have done it with respect to the high expectations.

Affect influenced bias occurs when there is a positive or negative emotional predisposition for a specific outcome or option (Finucane et al., 2000; Slovic et al., 2004). A participant from a project management firm explained that clients that are utilizing personal funds tend to 'count every cent' (Table 6, O9); claiming that this brings about higher probability of conflict as clients tend to feel that firms may be trying to make higher profits (Table 6, O3). We can see that this is a common phenomenon, emotional attachment to a product tends to affect decision making negatively. In the mobile phone industry, Nokia's top managers were found to have emotional attachment for utilizing their originally developed innovation while competitors developed other innovations and took over the market share (Vuori and Huy, 2016). Similarly, emotional attachment to one's finances affects decision making as investment in project-based innovations requires early investment of time (Table 5, EC10); e.g. scripting of repetitive tasks at the early design phase to avoid repetition when changes are made later in the project require high resources early. Therefore these changes in the budget are ones that the client should agree to, however, commonly not; the lack of foresight of some clients resulting from lack of knowledge and high expectations.

## 7 Conclusions

Empirical data was collected from Finland and Norway utilizing collaboration as a point of departure enabling holistic data collected; topics emerged following reality from the experiences of practitioners. Clients have a vital role toward project success and play a part in vital decisions during the end-to-end construction process. Empirical data showed well claimed factors such as lack of client knowledge of needs and technical aspects, ambiguity of client role and involvement. The existence of bias in decision making relating to the client is acknowledged in existing literature in this domain however lacks detail in the application of theories associated with bias. A gap was recognized and addressed where cognitive and motivational biases in client involved decisions were recognized. These biases were associated with empirical findings to enable in-depth understanding of reasoning behind client behavior and decision making to contribute to the understanding of the client. Client understanding is essential as the client is a key stakeholder involved in numerous decisions from the end-to-end construction process. The paper acknowledges the various types of bias, the manner in which empirical evidence shows emergence and relates normative beliefs to the biases. The emergence of bias was inevitably brought about by the existence of normative beliefs. Biases were found to alleviate one another distinctly depending on the particular project and were found to be non-mutually exclusive.

No study is without its limitations. For example, the highly variant nature of client organisations limits client specific generalisation from the findings. In addition, methodological limitations include the effect of gatekeepers in recruiting participants and from the highly qualitative nature of data resulted in a lack of statistical validity.

Despite these considerations, further work to gain greater consistency using a range of methodologies to verify the existence and estimate the effect of motivational and cognitive biases in client involved decision making is required.

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