DEVELOPING A FRAMEWORK FOR MEASURING COLLABORATIVE WORKING AND PROJECT PERFORMANCE

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There is evidence that higher degrees of collaborative working can generate more successful project performance, but there has been only limited research to systematically examine the specific impact of collaborative working on project performance. In particular, there is a lack of exploration of appropriate approaches to quantify the impact. In order to fill in this gap, this research aims to differentiate the different degrees of collaborative working that reflect a corresponding project performance. In doing so, the association could be made between collaborative working and project performance. In order to test the association, two key concepts (collaborative working and project performance) will have to be transferred into a form which is measurable. In this process, the concepts will be broken down into indicators, and further down into items, based upon which, Likert scales will be used to design the measurement of the concepts. By measuring the concepts, a range of collaborative working and their impact on project performance can be identified.

Keywords: collaborative working, measurement, project performance, taxonomy.

INTRODUCTION

In the UK, due to the effort of industry and government, there is a move from traditional, arms-length, contractual approaches towards more collaborative ones (e.g. partnering, alliancing etc.). Some researchers, for instance, Li *et al.* (2000), Ingirige and Sexton (2006) argue that alliancing has been used interchangeably with partnering; the other researchers for instance, Yeung *et al.*, (2007) argued that alliancing and partnering not only have some similarities but also have some differences. However, broadly speaking, both partnering and alliancing are two types of high degree collaborative working. It has been argued that such collaborative approaches (e.g. partnering) have positive impacts on project performance: e.g. saving cost, increasing quality and improved user satisfaction (Bennett and Jayes, 1995, 1998, Egan, 1998)

However, there is a lack of the systematic investment of collaborative working and its impact on project performance. Moreover, collaborative working is a complicated issue: it should be done in a proper way and for proper reasons in suitable projects (Bresnen and Marshall, 2000, Ng *et al.*, 2002, Eriksson and Pesämaa, 2007). (Saad *et al.*, 2002, Vaaland, 2004), therefore, argued that achieving a certain appropriate level of collaborative working is difficult. So, in order to achieve a better understanding of collaborative working and improve the efficiency of collaborative working, more detailed research is necessary to be conducted. Based on the above arguments, in

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order to fill in the current research gap, this research is going to examine a range of collaborative working by cluster analysis and explore their impact on project performance by building the association between the different degree of collaborative working and the corresponding project performance.

A BRIEF REVIEW OF COLLABORATIVE WORKING

As mentioned before, there has been a great deal of research examining collaborative working such as partnering and alliancing. For instance, Bennett *et al.* (1996), Barlow (1997), Larson (1997), Egan (1998), Thompson and Sanders (1998), Humphreys *et al.* (2003), Phua (2004), Ingirige and Sexton (2006), Yeung *et al.*, (2007) and so forth. However, they purely focused on partnering/alliancing, they did not explore a bigger picture from a broader perspective. So, this research will examine a range of collaborative working so as to get a bigger picture. Here, the concept of collaborative working means people working together. Through collaborative working, people can deliver value that would be impossible working individually (Planning Advisory Service, 2007). The basic rationale of collaborative working is to achieve synergy by combining resources from collective efforts. In this research, collaborative working is defined as 'two or more organizations jointly working together for mutual advantages, through which the parties can achieve bigger benefits than working separately'.

Obviously, when parties are working together, the results could be effective or ineffective. Thus, in investigating the results of collaborative working consideration must be given to both positive and negative attributes. In order to identify the positive attributes of collaborative working, an identification test has been adopted, as used by Tyler and Matthews (1996) and Li *et al.* (2000). With additional material from two important pieces of work by Mohr and Spekman (1994) and Lehtonen (2004), the final positive attributes are identified. Negative attributes were collected based on research undertaken by Ng *et al.* (2002) and Chan *et al.* (2003). The author also relied upon other research particularly the work of Lewichi *et al.* (1998) (trust and distrust), Yates and Hardcastle (2002) and Palmer (2002) (selfishness). Using those attributes as indicators, different degrees of collaborative working can be distinguished. But, before this is attempted, there are a number of other questions about collaborative working that need to be addressed.

WHY COLLABORATIVE WORKING IS NEEDED?

In its most basic sense parties enter into collaborative working because, by working together, they can achieve their respective objectives. However, collaborative working between client and contractor is often restricted, and dominated by the competitive context of the industry. This can result in adversarial attitudes, suspicion and consequent inefficiencies (Gidado, 1996, Pietroforte, 1997, Eriksson and Pesämaa, 2007). The driver for working together more closely (a higher degree of collaborative working) might be internal or external (Tyler and Blader, 2000, Planning Advisory Service, 2007). For instance, organizations voluntarily work together more closely to improve internal efficiency to get best value from one another's services (Ellinger, 2000, Fawcett and Magnan, 2002) or to respond to external challenges (e.g. competition) (Planning Advisory Service, 2007). This research will examine the driving forces of working together more closely from two perspectives: external forces and internal demands.

External forces: As the increased complexity of construction technology, the variety of building function, time pressure, the uncertainty and stronger competition in

construction market, client and contractor need to work together more closely to achieve better project performance than working separately (Gidado, 1996, Pietroforte, 1997, Eriksson and Pesämaa, 2007). Thus, the external environment can produce pressures on organizations, which push them to work together more closely to achieve collaborative advantage to face the challenges from the construction market. Through working together more closely, information and resources are shared, and a closer relationship will be formed (Egan, 1998, Wood, 2005).

Internal demands: Organizations have for many years tried to improve the efficiency of their interactions with their partners (Ellinger, 2000, Fawcett and Magnan, 2002, Barratt, 2004). Encouraging collaborative working can facilitate procurement (e.g. early involvement of contractor can make the contractor respond to the client's requests more quickly and more effectively). Particularly, through long-term collaborative working, the client can avoid repeat tendering and save cost and time Cox and Thompson, 1997). Thus, the internal demands attract the companies to enter into collaborative working to improve efficiency and to lower the transaction cost.

SPECIFIC BENEFITS OF COLLABORATIVE WORKING

Some benefits have been mentioned in the above description, for instance, by reinforcing collaborative working, internal efficiency could be improved, transaction cost could be lowered and a closer business relationship (partnership) could be formed to improve competitive advantage. In this research, the benefits of reinforcing collaborative working are focused on project performance. There has been some research arguing a higher degree of collaborative working such as partnering, can have positive impacts on project performance e.g. saving cost and time, increasing quality, decreasing litigation and promoting greater innovation and improved user satisfaction (Bennett *et al.*, 1996, Black *et al.*, 2000, Bresnen and Marshall, 2002, Phua and Rowlinson, 2004). It is necessary to explore the full benefits of reinforcing collaborative working on project performance.

Cost, time and quality are known as the 'iron triangle' to evaluate the project performance (Mohsini and Davidson, 1992, Atkinson, 1999, Kerzner, 2003). Liu and Walker (1998) and Leung *et al.* (2004) even identified satisfaction (quality satisfaction and service satisfaction) as playing a key role in deciding the result of project performance. Hughes *et al.* (2004) argued safety performance could also be the primary determinant of project performance. More recently, Constructing Excellence (2006) identified defects as a key index to evaluate project performance which they emphasized using KPIs (key performance indicators) originally launched by CBPP (1998). Thus in this research, cost, time, safety, defects, product satisfaction and service satisfaction have been chosen as project performance indicators to examine the benefits of reinforcing collaborative working.

RESEARCH MODEL

Based on the above description, different degree of collaborative working will result in different project performance. So, in this research, the unit of analysis is the project, or more specifically, the employer-contractor relationship in an individual project. The whole research has two stages: in stage one (figure 1a) degrees of collaborative working will be differentiated in terms of its indicators (attributes); in stage two (figure 1b) the impact of collaborative working on project performance will be explored.

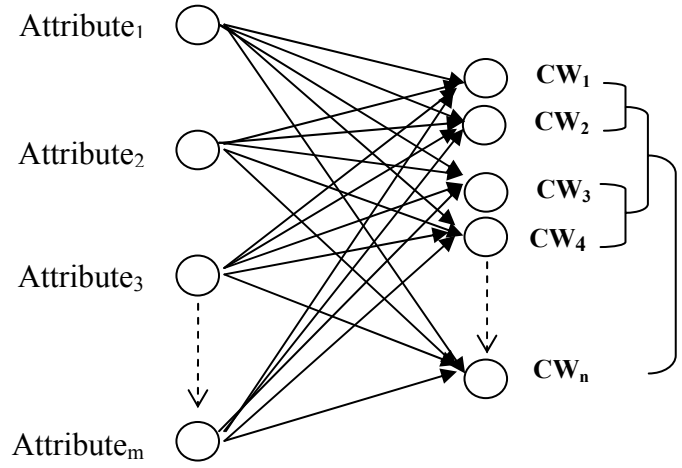

Figure 1a: A taxonomy of collaborative working (stage 1)

In Figure 1a, collaborative working is differentiated by measuring levels of its attributes (attribute1-trust, attributes2-commitment and so forth). Suppose there are 'm' attributes (variables) that determine the degree of collaborative working. Based on 'm' variables, cluster analysis will be conducted. Through cluster analysis, a 'cluster analysis tree' will be produced which presents the distance amongst the different degrees of collaborative working and the process of combining each degree of collaborative working. In the second stage of research, the different degrees of collaborative working will be connected with the corresponding project performance (see figure 1b).

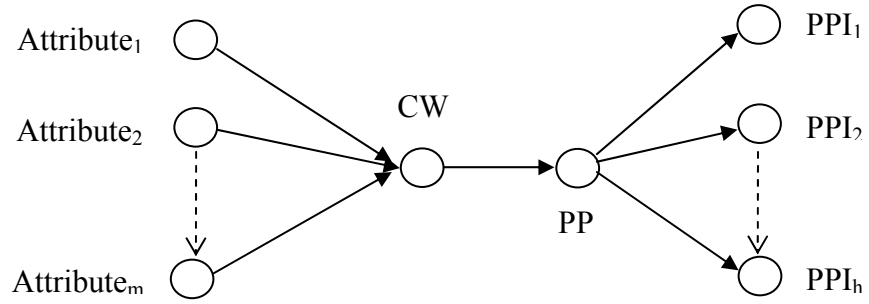

Figure 1b: Relationship between CW and project performance (stage 2)

In figure 1b, the measures of attributes of CW and a number of project performance indicators (PPI1…h) will be viewed as independent and dependent variables (respectively) for a regression and correlation analysis to be conducted. For the detailed measure design for attributes of CW and project performance indicators, please see the below section.

MEASUREMENT DESIGN OF VARIABLES IN MODEL

Following the above research model, the next step is to measure collaborative working and project performance respectively. Oppenheim (1992) argued that measurement is not only for measuring a specific issue e.g. the size of table but also for evaluating non-factual things e.g. awareness, value, perception, opinions, beliefs and attitudes. Following this line Trochim (1997) and De Vaus (2002) identified four levels of measurement: nominal, ordinal, interval and ratio. At nominal level, there is no rank-order between different categories. At ordinal level, we can rank-order categories from low to high but we can not specify in numeric terms how much difference there is between the categories. At internal level, the categories can be ranked from low to

high in some meaningful way. At ratio level, there is an absolute zero that is meaningful. This means a meaningful fraction (or ratio) with a ratio variable can be constructed. In this research, in order to measure collaborative working and project performance, the analytic hierarchy process (AHP) will be used in the measurement design. Saaty (1980) pointed out that AHP means to break a problem down and then aggregate the solutions of all the sub-problems into a conclusion. Applying this idea into measurement design, two key concepts (collaborative working and project performance) will be broken down to different indicators (for collaborative working, the above refer to them as attributes). The conclusion of those indicators will be the conclusion of collaborative working and project performance. Furthermore, each indicator e.g. trust, commitment (for CW) and cost (for project performance) will be broken down to different items which are used to evaluate the degree of each indicator (see figure 2).

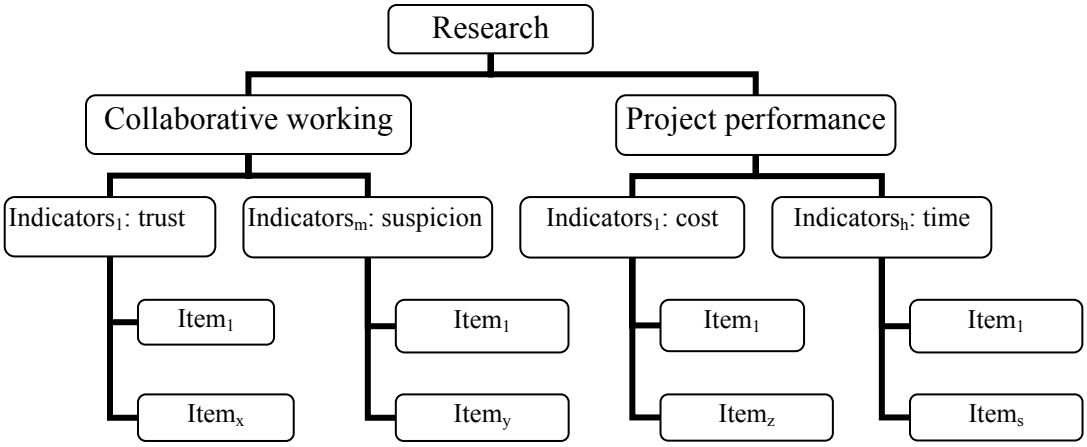

Figure 2: Analytic hierarchy process of the research

Multiple items will be used to measure those indicators. As De Vaus (2002) shows, multiple-items have advantages over a single one, because they;

- are more appropriate for the complexity of the concept than a single item
- assist in developing more valid measures avoiding some of the distortions and misclassification by using only single item measures of complex concepts
- increase reliability
- enable greater precision
- summarize the information conveyed by a number of questions into one variable they considerably simplify analysis

Respondents will be invited to evaluate those multiple items (item1….itemx) by recalling their latest project. The range of their response is from strongly agree (7) to strongly disagree (1); this is a commonly used rating scale (Trochim, 1997) and will facilitate future statistical analysis (for details see section ‘an example of variable measurement design’).

BUILDING ATTITUDE SCALES

Since the respondents will evaluate those items based on their perception, attitude and opinion, this type of scale is called an attitude scale. Its main function is to divide people into different groups with respect to a particular attitude, placing people on a continuum in relation to each other, in relative and not in absolute terms (Oppenheim, 1992). Saunders et. al. (2003) argued, for opinion/attitude data collection, rating or scale questions are good choices. So, attitude scales will be used to design a

measurement for collaborative working and project performance. Regarding attitude scale techniques, Oppenheim (1992) identified the four best-known methods of attitude scaling as the Bogardus, Thurstone, Guttman and Likert scales-all of which are named after their developers. Likert scale is chosen here because;

- It is more common in recent year (De Vaus, 2002)
- It tends to have a good reliability (Oppenheim, 1992)
- It is less laborious (Oppenheim, 1992)

The process of designing attitude scales according to Oppenheim (1992) and De Vaus (2002) is to define the indicator; generate item pool for each indicator; select items and create the final item list.

- Define the focus (identification of indicators), see figure 2, the indicators have been identified through literature review
- For each indicator, generating potential item pool: reviewing related literature for each indicator; drawing up a conceptual sketch of the attitude clusters in question, with their likely linkages and possible undercurrents (Oppenheim, 1992); designing appropriate attitude statements for all items.
- Select best items: validity is be ensured in generating item pool through reviewing related literature, and improved by conversation with the supervision team, further improved by pilot study.
- Uni-dimensionality: the item-to-scale coefficient is between 0 and 1 (to ensure every item measures the same thing). As a rule of thumb, if this coefficient is less than 0.3 then the item is dropped from the scale.
- Reliability: Cronbach's alpha coefficient (between 0 and 1), as a rule of thumb, alpha should be at least 0.7 before we say that the scale is reliable.
- Creating the final list of multi-item measurement to enter into data analysis

AN EXAMPLE OF VARIABLE MEASUREMENT DESIGN

In terms of the above descriptions, collaborative working and project performance are two key concepts in this research. By using analytic hierarchy process, they are broken down into indicators e.g. trust, commitment, cost, time etc. (for details see figure 2). Through literature review, the items design for each indicator will be conducted. There has been a great deal of description about each indicator. For instance, trust is described by Sako (1992), Wood and McDermott (1999), Wong and Cheung (2004) etc. Based on their arguments, the items for measuring trust have been developed respectively for the client and contractor (see Table 1):

.Table 1: Items of measuring trust

Items for client	**Items for contractor**
The contractor has a good reputation	The client has a good reputation
I have high confidence in the contractor	I have high confidence in the client
I expect the contractor to take initiatives even without specific written agreement	I would take initiatives even without specific written agreement
We trust each other	We trust each other
I trust the contractor's decisions will be beneficial for our business	I trust the client's decisions will be beneficial for our business
I am satisfied with the terms of the contract	I am satisfied with the terms of the contract
Concessions are important to build a trusting relationship	Concessions are important to build a trusting relationship
Both sides have made concessions to build trust	Both sides have made concessions to build trust

The purpose of those items is to measure the degree of trust between client and contractor. Based on those items, the respondents are invited to evaluate them in a Likert way. There are seven choices for respondents to show their agreement or disagreement about those items: 1- Strongly Disagree; 2- Disagree; 3- Slightly Disagree; 4 - Neither disagree nor agree; 5- Slightly Agree; 6- Agree; 7- Strongly Agree. Before those items enter into the model testing, uni-dimensionality and reliability will be analyzed. The items with low reliability (<0.7) and low uni-dimensionality (<0.3) will be dropped to keep the measurement of high quality. The other indicators such as commitment, cost, time etc. will be dealt with in the same way. Through this, the measurement of collaborative working and project performance can be formed and the research model can then be tested

CONTRIBUTION

The first contribution of this research is to clarify the uncertainty that surrounds the definition of collaborative working, from this, the confusion between partnering, alliancing and collaborative working might be avoided. There is a range of types of collaborative working between client and contractor. By designing the measurement of collaborative working, it is possible to distinguish the different degrees of collaborative working in this range. From doing so, the difference and similarity between different degrees of collaborative working could be examined, which is the purpose of the first stage in this research. Secondly, through designing the measurement of project performance, the association between collaborative working and project performance can be examined, which is the purpose of the second stage of this research. In the first stage, cluster analysis will be the principal approach to the data; in the second stage, regression and correlation analysis will be carried out. Thus, finally, a taxonomy of collaborative working will be produced and the impact of collaborative working on project performance will be identified in a more precise way.

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