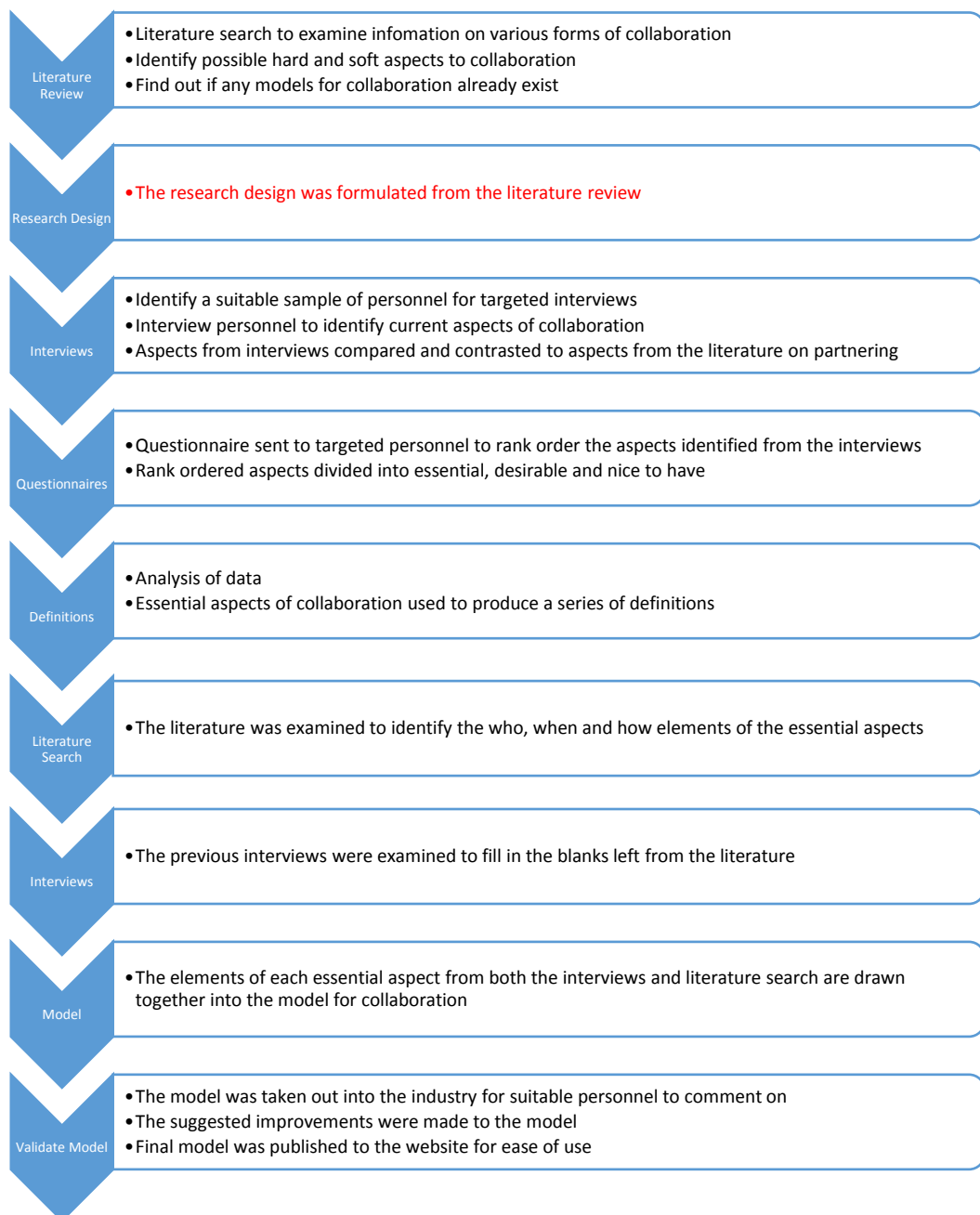


Methodology



Chapter Three

Methodology

Chapter Three Aims

- 1. Review of philosophical worldview and justify choices taken.**
- 2. Presentation and justification of the research strategy adopted in the study.**
- 3. Presentation and justification of the research methods utilised in the study.**
- 4. Contribution to knowledge.**

3.1 INTRODUCTION

In the previous chapter the literature identified 71 aspects linked to collaboration. However, the literature failed to indicate the relative importance of the aspects to each other. The literature did not reveal detailed definitions and only provided a few conceptual models and no practical models for use by industry stakeholders. Having identified how a contribution to knowledge can be made, the aim of this chapter is to describe the possible research designs available to the Author.

The purpose has been to base the research on a very thorough methodology. After a review of methodological principles and alternative approaches the methodology presented here proceeds through six distinct phases:-

Phase One - Identification of aspects of collaboration from the literature.

Phase Two - Identification of the current collaborative aspects.

Phase Three - Rank ordering of collaborative aspects.

Phase Four - Essential aspects and production of the definitions.

Phase Five - Generation of a model for collaboration.

Phase Six - Validating collaborative model.

The chosen research design and the methodology used in this research is presented and justified in this chapter. The research is then described step by step from the identification of aspects to the validation of the model.

3.2 RESEARCH METHODOLOGY

Creswell (2009) describes the three possible research designs as quantitative, qualitative and mixed methods. Quantitative research can be used to test objective theories or to examine the relationships between variables (Creswell, 2009). Qualitative research is a way of exploring and understanding the views and behaviour of individuals or groups. Mixed methods is where both qualitative and quantitative research is used, which is considered stronger by many leading Researchers such as Bryman and Bell (2007).

Creswell (2009) describes how there are three factors to consider when designing research projects, these are:-

- Philosophical Worldview / Ontology and Epistemology
- Strategies of inquiry
- Specific methods of data collection

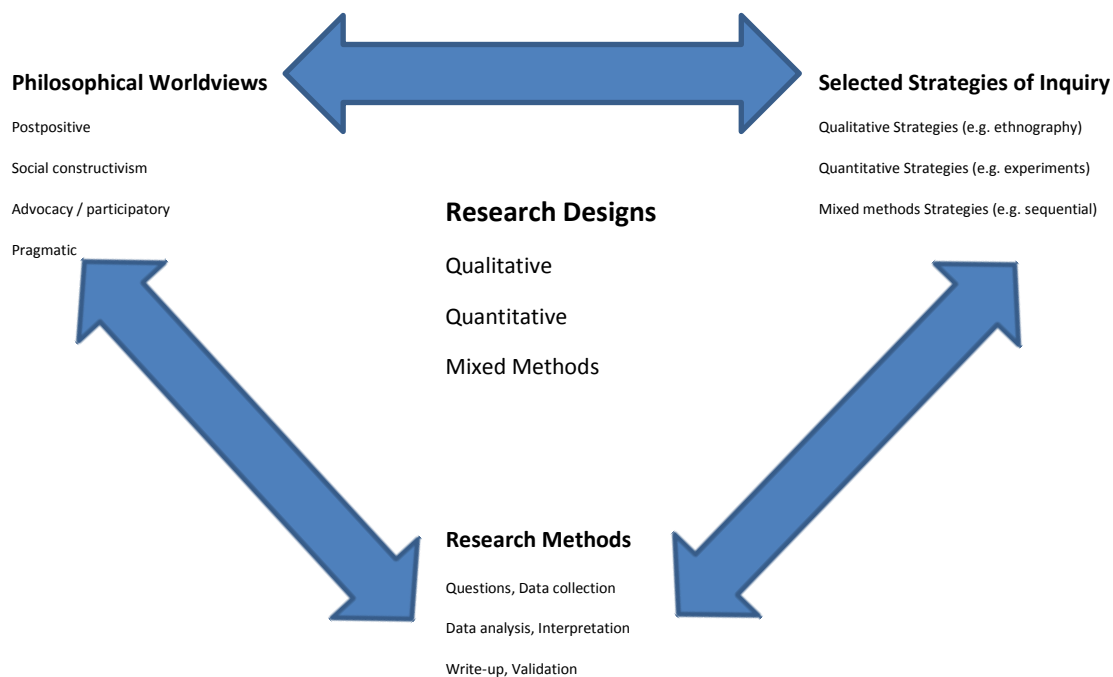


Figure 5. Research design (Taken from Creswell, 2009)

3.2.1 Philosophical Worldview

Philosophical worldview has been described as the “general orientation about the world and the nature of research that a Researcher holds” (Creswell, 2009). Bryman and Bell (2007) describe the four common world views of postpositivism, constructivism, advocacy and pragmatism.

3.2.1.1 *Post positivism*

Post positivism is considered as the traditional form of research and involved the formation of a theory on which data were collected to either support or refute the theory. It is a form of research that aims to develop true statements that explain the relationship between two variables and is linked to quantitative research methods (Hart, 2005). Post positivism was not adopted for this thesis as the Author felt it is not possible to reduce the data to produce a single theory. Post positivism could identify if the 71 possible aspects are still perceived as important to collaboration but this approach would not allow the production of a model.

3.2.1.2 *Social constructivism*

The social constructivism worldview is linked to qualitative research methods. Broad questions are asked so that the participants are allowed to construct the meaning of the situation. This method is often used to examine processes of interaction (Creswell, 2009). Constructivism was considered for this thesis as it seeks to make sense of the meanings of others but was finally excluded as not all the aims could be achieved in this manner. This worldview is conducive to the production of a model but would not identify the relative importance of each of the aspects to each other. This is of importance in the formulation of a definition. It would also not allow a model to be produced that focussed on those aspects that can potentially provide the greatest success.

3.2.1.3 *Advocacy and participatory*

The advocacy and participatory worldview is linked to quantitative research and is entwined with politics and a political agenda and addresses important social issues (Hart, 2005). The philosophical worldview advocacy was excluded as this research is not political in nature. While the UK Government have promoted the use of collaboration through various mechanisms the aim of this research is to improve the success of projects for the personnel managing the project. These personnel are not politically minded and therefore whilst acknowledging that the forces behind collaboration may be political, the day to day running of a collaborative project is not. From the point of view of the Contractor it is an avenue to get work. They have had no choice and are not there due to politics.

3.2.1.4 *Pragmatic*

Pragmatism is concerned with applications and finding solutions to problems and does not see the world as an absolute unity (Bryman and Bell, 2007). The philosophical worldview that best fits the Author's outlook is pragmatism. Pragmatism focuses on what works and finding solutions to problems and draws from both qualitative and quantitative assumptions (Creswell, 2009). Pragmatism, it was felt, was the most appropriate as it fits in best with the aims and objectives of the research in this thesis. An initial objective for the research was to identify what aspects are currently considered to be part of a successful collaborative project. This required a qualitative

approach. The aspects then needed to be rank ordered which required a quantitative approach. Finally information about who should be responsible for these aspects, at what point in the project they become important and how should they be implemented required a qualitative approach. The mixed method approach therefore was important in obtaining the breadth and depth of information required to complete all the aims and objectives.

3.2.2 Strategies of Inquiry

Having chosen the most appropriate philosophical worldview the strategy of inquiry was examined. Strategies of inquiry are models that use quantitative, qualitative or mixed method designs to provide specific direction for the procedures in the research design (Hart, 2005).

3.2.2.1 Quantitative strategies

Examples of quantitative strategies include experimental research. Experimental research consists of changing or influencing one variable to see how it affects the outcome of another variable (Creswell, 2009). This method does not suit the aims and objectives of the Author's research.

Survey research is another strategy. Survey research provides a picture of trends using numerical data by using questionnaires or structured interviews (Hart, 2005). Surveys allow inferences to be made from a sample of people to the population. Surveys are useful as data can be collected quite quickly (Creswell, 2009). The quantitative strategy would only suit part of the research that involved putting the data into priority order but would not be suitable for gaining people's opinions on collaboration.

3.2.2.2 Qualitative strategies

There are many examples of qualitative strategies. Ethnography involves the Researcher studying an intact cultural group in their natural environment (Creswell, 2009). Grounded Theory uses the views and opinions of participants using multiple stages of data collection to form a general abstract theory of a process (Dainty *et al*, 2000). Case Studies are an in depth study of an event, activity or process using a variety of data collection procedures over a prolonged period (Creswell, 2009).

Phenomenological research is a prolonged study of people's experiences to understand the meaning of the process (Bryman and Bell, 2007). Narrative research is where individuals are asked to provide stories about their lives and they are compiled together (Creswell, 2009). A qualitative strategy would be more suitable for collecting data on the opinion of people involved in collaboration but would miss data on the importance of aspects.

3.2.2.3 *Mixed methods strategies*

Sequential mixed methods is where the Researcher uses another method of data collection to elaborate on the data found using the first method (Hart, 2005). Concurrent mixed methods involves the Researcher merging both quantitative and qualitative data collection (Bryman and Bell, 2007). Transformative mixed methods uses a theoretical lens throughout the design and then uses either sequential or concurrent mixed methods (Creswell, 2009). Creswell (2009, pp 62) states that a theoretical lens provides an "*overall orientating lens*". The theoretical lens guides the questions asked and dictates how the data were to be collected and analysed (Creswell, 2009). A mixed method strategy was found to be the most suitable strategy for the Author's research. Qualitative data would allow the insight into how people view collaboration while the quantitative data would allow this data to be rank ordered to facilitate the drawing of the data into a model. Of the mixed method strategies available a concurrent mixed method was not suitable for the research due to the complexity of collaboration. A sequential mixed method discussed by Hart (2005) was utilised which allowed the qualitative data to be collected and then rank ordered using quantitative data, although some concurrent mixed method was also utilised within the questionnaire. Then additional qualitative data were collected and analysed to help inform the model. The Author's aim is to compare the data collected to the existing theory but not to use the literature to guide the research design.

Mixed methods can be used to both corroborate and also expand one's knowledge (Johnson and Onwuegbuzie, 2004).

Johnson and Onwuegbuzie (2004) describe that mixed methods research can be mixed model or mixed method. Mixed model mixes qualitative and quantitative approaches within or across stages. Mixed method includes a quantitative phase and a qualitative

phase. The Author's approach uses both mixed methods and mixed model as described in figure 6.

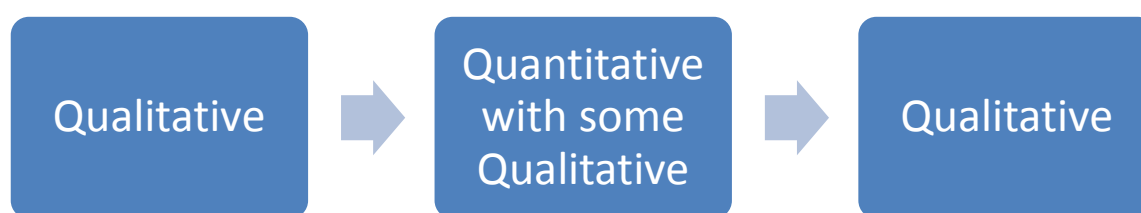


Figure 6. Mixed methods approach

3.2.3 Research Methods

Once the strategy had been chosen the specific methods could be examined. Having chosen a mixed methods strategy, the specific methods of data collection can draw from both qualitative and quantitative methods as best determined by the aims and objectives of the research. Specific research methods encompass data collection, analysis and interpretation. The type of methods used depends upon the data required (Bryman and Bell, 2007).

3.2.3.1 Quantitative methods

Quantitative methods should use predetermined methods with closed ended questions. The sort of data that should be collected is performance, attitude, observational and census data. The analysis and interpretation should be statistical. The methods that could be used included questionnaires, observational and comparative analysis (Hart, 2005).

The data collection method the Author thought best fit the aims and objectives is self-administered questionnaires. According to Creswell (2009) a random sample provides the best data. A random sample was not possible for this research as the Respondents need to understand collaboration within the UK construction industry. Therefore to improve the validity initial Respondents (clustering) were approached via Constructing Excellence Wales but were asked to send on the questionnaire to their acquaintances. This is snowball sampling and is discussed in 3.5.1.1 (Bryman, 2008). This reduced the

targeting and increased randomisation to improve the ability to generalise to the population.

3.2.3.2 *Qualitative methods*

Qualitative methods should use emerging methods (adapting to the situation) with open ended interviews. The sort of data that should be collected is interview, observational, document and audio visual data. The analysis should be of text and images and the interpretation of themes and patterns (Creswell, 2009). The methods that could be used included interviews, life history, case study and concept mapping (Bryman and Bell, 2007).

Observations are useful for Researchers to gain first-hand experience but it can take time to build up enough of a rapport so the Researcher is not seen as intrusive (Creswell, 2009). The Author did not have the necessary time scale for this procedure.

Documents are useful as they can be accessed at convenient times but not all documents may be accessible to the public (Creswell, 2009). The Author felt that this procedure was not suitable for the research design as some of the documents would be commercially sensitive and therefore the Author would be unable to access sufficient information.

Interviews provide control over the line of questioning, however the information is the opinions of the Interviewees and therefore filtered by their views. Not all people are articulate and perceptive (Creswell, 2009). In the Author's opinion interviews are the most appropriate procedure as they provide the most control. To mitigate against the limitations of the procedure more people from various backgrounds were interviewed. These Interviewees included both civil engineering works and building projects and representatives of both the Contractor and the Client. In case the Interviewees were not very articulate several non-leading supplementary questions were prepared to help draw them out. It was suggested that they could email information to the Author following the interview.

3.2.3.3 *Mixed methods*

Mixed methods can utilise both predetermined and emerging methods with both open and close ended questions. Open ended questions allow Interviewees to explain their interpretation. Closed ended questions allow Respondents to select from a range of options. Closed ended questions are a good method of collecting data that can be analysed quickly statistically (May, 2011). Multiple data forms can be collected. The analysis can be both statistical as well as text or image and the interpretation of multi databases (Creswell, 2009). The possible methods in a mixed method approach could have involved any techniques from qualitative and quantitative methods such as nominal group (a group identifying issues), case study, comparative analysis (comparison of two or more cases), interviews and questionnaires (Hart, 2005).

The mixed methods approach aims to collect multiple data using different approaches so that the resulting data utilizes the strengths of both qualitative and quantitative research while minimizing the weaknesses (Johnson and Onwuegbuzie, 2004).

The Author's design includes both interviews and questionnaires. The qualitative interviews were a good method to tap into Interviewee's perspectives on what they perceive as collaboration. They also indicated that some aspects were more important than others. These interviews would not produce valid data on the relative importance of each aspect. Therefore, quantitative questionnaires were used to measure the importance of each aspect so that they could be analysed statistically.

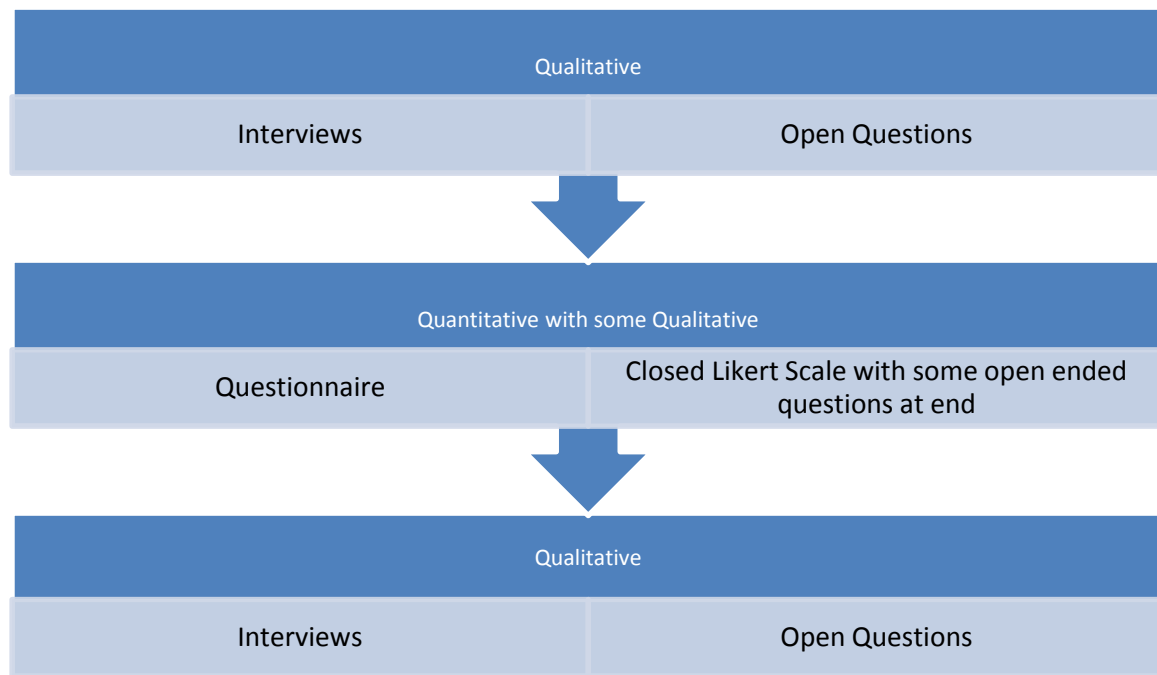


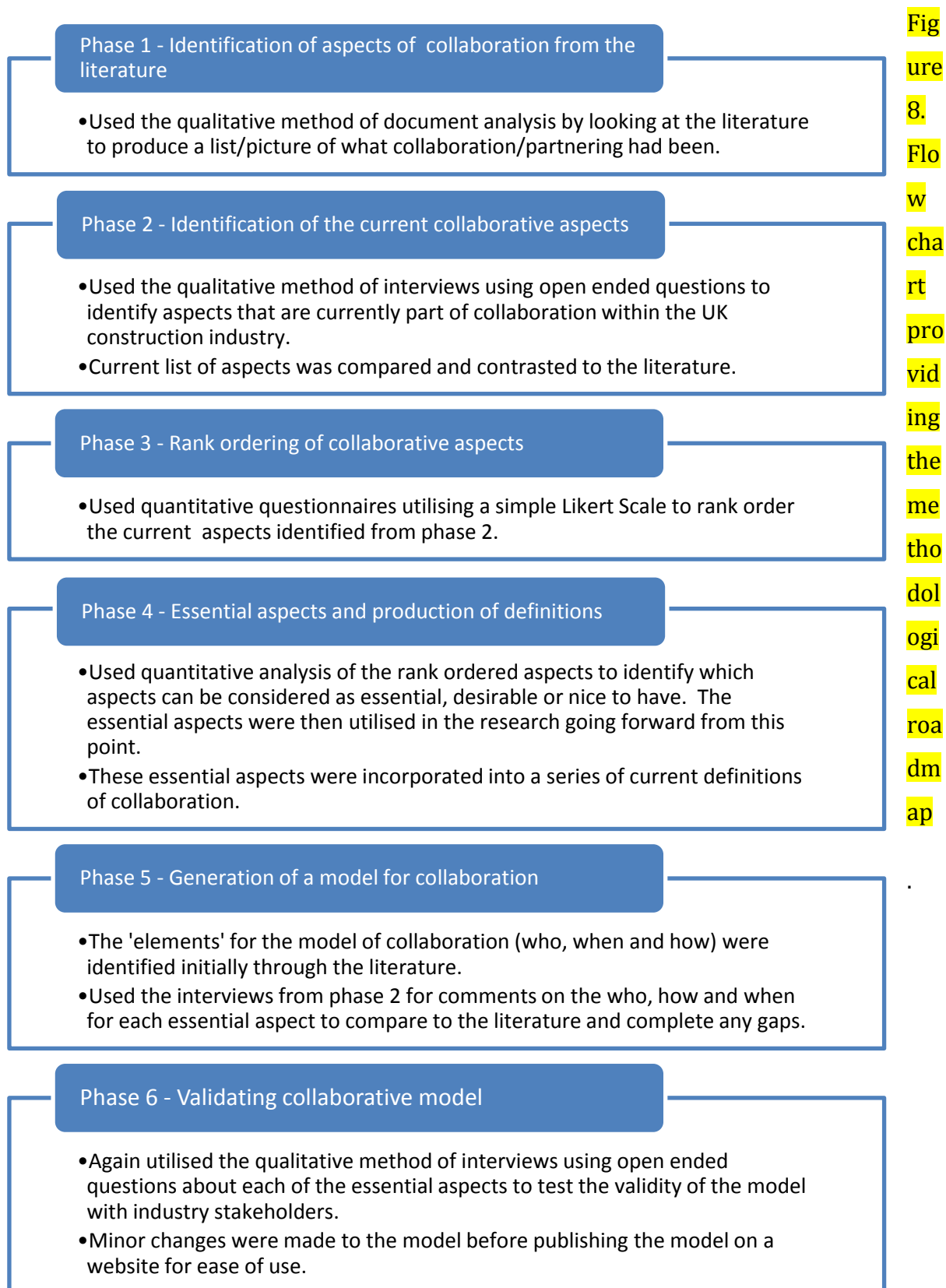
Figure 7. Data collection flow chart

The open ended questions at the end of the questionnaire gave the Respondents an opportunity to disagree or add more aspects. This, according to Johnson and Omwuegbuzie (2004), helps improve generalisability.

3.2.4 Summary of the Methodological Approach Used in this Thesis

The research design consisted of a pragmatic approach with a mixed methods strategy. The research design utilised both qualitative open ended interviews and quantitative questionnaires as research methods. The research design was then used to inform the methodological approach This incorporated specific data collection methods and how the data would be analysed and interpreted.

The flow chart in Figure 8 provides a methodological thesis roadmap as an aid in following the logic of this research.



3.3 IDENTIFICATION OF ASPECTS OF COLLABORATION FROM LITERATURE

The preliminary research found that incentivisation on its own would not ensure a successful collaborative project. Therefore, when the research progressed to the PhD objectives, secondary sources were examined to identify possible aspects that were important within collaborative projects.

3.3.1 Sources of Data for Initial Literature and Information Search

Secondary data were obtained from construction and business journal papers to identify potential aspects within collaborative projects (see list in Appendix 11). These are presented in Chapter Two.

3.3.2 The Classification of Information from the Initial Literature Review

The secondary data obtained from the journal papers identified information relating to aspects that may be involved in producing successful collaborative projects. These were further divided into soft aspects and hard aspects.

The initial research into secondary sources on collaboration revealed that secondary sources (see Chapter Two, section 2.8) were primarily written by academics. The majority of papers used were about partnering. Seventy one aspects to collaboration were identified from the literature but the Author had anecdotal evidence from her MSc research that partnering was evolving and that not all aspects were still considered useful to a successful project. To balance this the research needed to gather the opinions of people involved in the collaborative process.

Having identified the possible aspects from the secondary sources the research then moved on to collect primary data. This list of aspects identified from secondary sources was compared and contrasted to the first batch of primary data collected to identify if and how the concept of partnering was evolving into this new collaboration.

3.4 IDENTIFICATION OF THE CURRENT COLLABORATIVE ASPECTS

Interviews were used to gather data on the aspects of collaboration from construction professionals experienced in collaborative projects on how they viewed collaboration. The data from the interviews were analysed and a list of aspects for collaboration was

produced. These were compared to the literature review to see if there were new aspects or any not discussed. This was to examine if the industry has adapted partnering to fit the industry.

3.4.1 Interviewee Selection Strategy

To produce a list of aspects for successful collaboration it was important to target the right audience. Therefore, selective sampling was carried out. Rather than relying on random selection the sample was selected as the Interviewees had to understand and have experience of collaboration within the UK construction industry. Using contacts from Constructing Excellence Wales possible Interviewees were identified from recent collaborative projects. Constructing Excellence Wales was selected as the Author, being self-funding, had no resources for travelling so therefore needed local contacts. However, Constructing Excellence Wales, as a national organisation, has access to relevant people appropriate for the Author's data collection. Also, Constructing Excellence Wales is a part of Constructing Excellence in the UK which helps to broaden the relevance of the data.

With regards to the number of interviewees required Creswell (2009), Bryman (2008) and Knight and Ruddock (2008) discuss how sample sizes can be smaller in qualitative research designs. They do not give details of how to calculate them. Cohen *et al* (2011) suggest a minimum of 15 interviews. However, Mason (2010) and Dworkin (2012) discuss saturation based on the point of diminishing returns. They describe how more data does not necessarily lead to more information as qualitative research is looking for meanings.

3.4.2 Willingness and Availability to be Interviewed

The Author approached Constructing Excellence Wales and they agreed to be interviewed but also to put the Author in contact with other suitable people within the industry and a sample of individuals as possible Interviewees was created.

Ten people were initially approached as a starting point for their availability to be interviewed. As expected some of the people approached were not available for interview within a reasonable period of time due to holidays and leave. Using diminishing returns seven people were interviewed: three Client representatives, three

Contractor representatives and one Interviewee who was an Advisor and whose views did not come from either perspective.

3.4.3 Criteria for Selection

Contract Managers, Cost Managers, Clients and Project Managers with sufficient experience to make judgments on aspects of collaboration were targeted for interviewing.

The personnel interviewed all worked in large organisations across the UK within the construction industry, from a cross section of project types including major construction projects with associated infrastructure works, civil engineering works and smaller building projects. The Interviewees had a minimum of ten years' experience of working within a collaborative environment with four of them having worked for over 15 years on collaborative projects. It was decided that sufficient interviews had been carried out as the number of new aspects reduced with each interview and no new aspects were obtained from the final interview as shown in Figure 9.

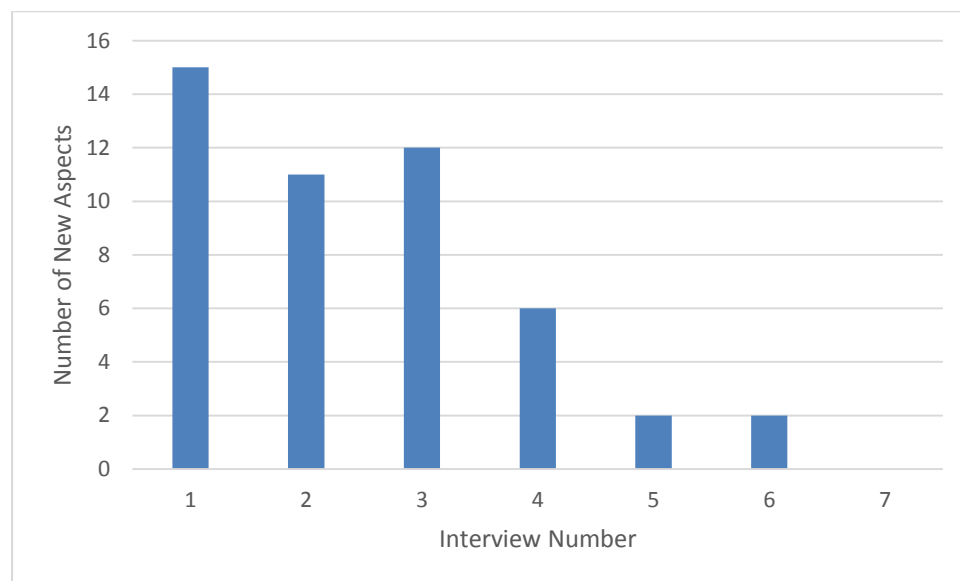


Figure 9. Graph showing the number of new aspects identified in subsequent interviews

3.4.4 Interview Questions and Format

Interviews were used to explore the Interviewees' understanding of the term collaboration. For the full set of questions please see Appendix 12.

The Interviewees were asked some general questions about their experience to confirm their suitability and also for possible analysis of the data later.

The interview was a semi-structured, open ended interview which included five questions covering why both Contractors and Clients enter into collaborative arrangements and the benefits they get from collaboration. They were also asked their opinion on the difference between collaboration and partnering. The questions were kept general to bring in as much data as possible so it could be compared and contrasted to the secondary data from Chapter Two. The interview was piloted and worked well and so the only changes made were to draw out individuals on points made for clarity.

The Interviewees were thanked for their participation and asked to contact the Researcher by email should anything else relevant be subsequently identified.

3.4.5 Interview Analysis

These interviews took about 30 minutes and were all transcribed. The transcribed interviews were then examined to identify all aspects mentioned. The flow diagram in Figure 10 describes how the data were analysed.

From the Interview process with a selected sample a total of 48 aspects were identified.

The list of 48 aspects gathered as primary data from these interviews were compared to the 71 aspects identified from secondary sources reviewed in the Author's initial literature review which was undertaken to compare and contrast partnering to collaboration. The interviews' purpose was to identify the current interpretation of collaboration in the industry. Some aspects were mentioned more frequently than others in the interviews but quantitative data were required in order to rank order the aspects. The list of aspects (described in Chapter Four, section 4.4.3) was then used to

produce the questionnaires to answer the question of relative importance of each aspect to each other.

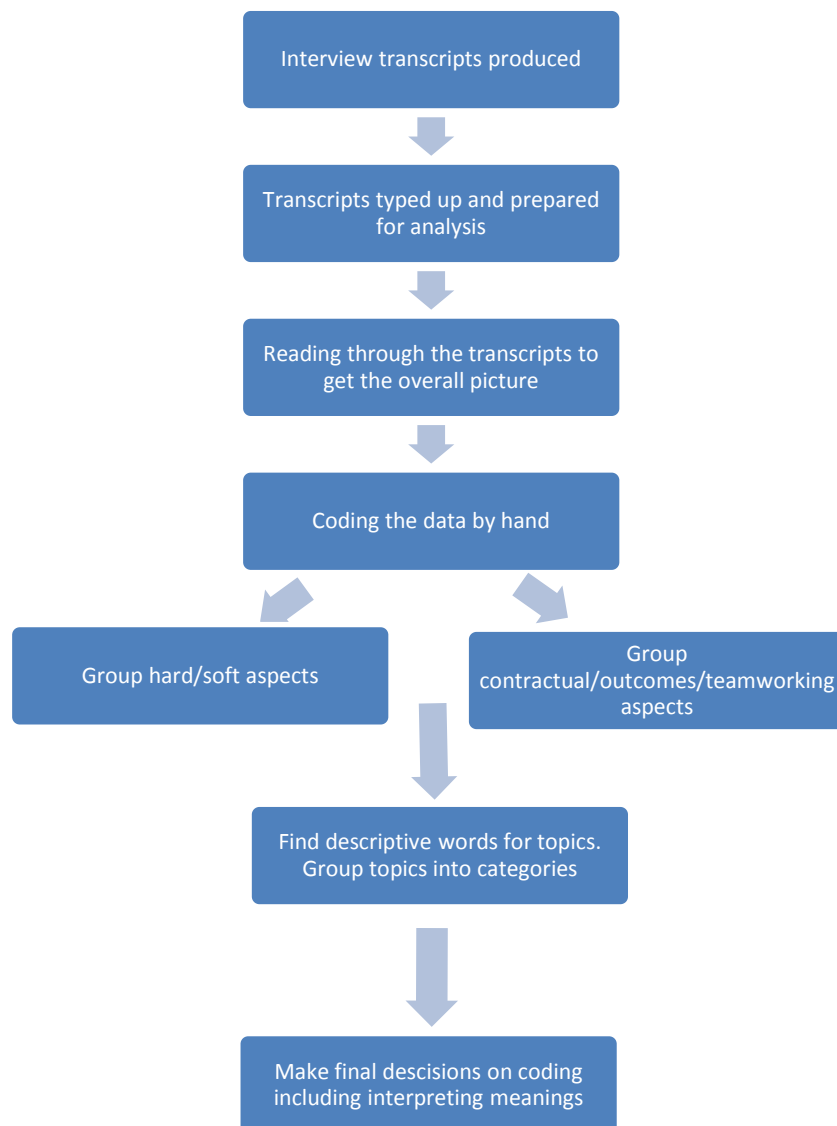


Figure 10. Flow diagram of interview analysis (adapted from Creswell 2009)

From a methodological perspective it was decided that it would more consistent to use the 48 aspects identified from the interviews to take forward to the next stage of the research. This maintains the integrity of the data as it is the product of direct contemporaneous primary research. The 71 aspects identified from the literature represent what partnering was or has been over the past 20 plus years. The aim of this

research is to define what collaboration is currently seen as within the industry and produce a model that the industry can identify with therefore it is only the 48 aspects from the interviews which were taken forward to Chapter Five. Thirty one of these 48 aspects were noted in the literature review but 17 of the 48 aspects were not identified in the literature.

For the next two phases of the research only the aspects identified from the interviews were used so that the definitions and model are relevant to the current industry.

3.5 RANK ORDERING OF COLLABORATIVE ASPECTS

The list of aspects identified in the interviews was then used in a questionnaire utilising a Likert scale to rank order the aspects. The results obtained were used to produce a definition and inform the generation of the model.

3.5.1 Population Sample

Targeted sampling was carried out as the Respondents had to have an understanding of collaboration. As with the previous interviews, Constructing Excellence Wales provided the contacts to broaden the relevance of the data. The target sample was set at 50 but more importantly the sample had to achieve statistical reliability as described in Chapter Five (section 5.4.2).

Bryman (2008) described how it is not possible to set up a framework for certain populations. As personnel with experience in collaboration were required to collect relevant data a sampling framework was not an option. Snowball sampling is suggested by Bryman (2008) as an alternative. Snowball sampling is where an initial selected sample is sent the questionnaire but then the initial sample send the questionnaire on to all their acquaintances and then they in turn send it on further until no more questionnaires are returned. This has lower generalisability than probability sampling but is better than a selected sample (Bryman, 2008). Snowball sampling was therefore used to keep as much generalisation as possible.

3.5.2 Sample Contact Method

The pilot questionnaire was distributed by hand to people in the industry known by the Author. The main issue raised was about the structure of some of the aspects which was addressed by writing all the aspects as statements. Once the questionnaire had been improved a survey website was utilised to increase the coverage of the questionnaires. The link was sent to the contacts provided by Constructing Excellence Wales, who had agreed to distribute the questionnaire to other people they knew with suitable experience and also asked them to re-forward the email.

3.5.3 Respondent Selection Criteria

A questionnaire was used as it allowed the Respondents to provide their opinion on the relative importance of the aspects of collaboration. This provided data that were easily analysed and was also a method suitable to collect the volume of results required for this research. In choosing a sample the relevant role (Client/Contractor), experience, type of project (Building or Civil Engineering projects) and geography (experience within the UK) were considered important. Therefore, selective sampling was again carried out to ensure that the Respondents had the level of understanding to make informed choices. To produce a set of relevant data it was important that the sample had experience of collaboration. Contract Managers, Cost Managers, Clients, Quantity Surveyors and Project Managers were targeted. They were chosen for their understanding of contracts, management and the day to day running of the site enabling them to make judgments on the importance of aspects of collaboration. It was decided to send the questionnaire to people working in both civil engineering and building sector projects and from various sized projects to get a broad cross section of the UK construction industry. The Respondents were required to indicate the number of years they had been involved in collaborative projects. Any results from people with less than one years' experience of collaborative projects were discarded. Table 16 shows the divide of experience (see Chapter Six, section 6.2.2).

3.5.4 Preliminary Questionnaire Design

An initial questionnaire was sent out to a small sample of six people to complete and provide feedback on the 'functionality' of the questionnaire.

The questionnaire was quite long. This was due to the fact that it was necessary to identify the relative importance of the 48 aspects derived from the interviews. Therefore, the rest of the questionnaire was kept to the bare minimum so that people would complete the questionnaire and not just give up. The Author was keenly aware of the need to provide a valid completion rate.

The aspects derived from the interviews were not always clearly understandable and the aspects were expressed in a variety of different forms which was confusing. Therefore, the results of the interviews were converted into standardised statements and a pilot study carried out.

3.5.5 Pilot Study of Questionnaire

As described the trial questionnaire was sent out to six people (see Appendix 13). The feedback that was received was incorporated by altering the wording of some of the statements and the delivery of the questionnaire was reconsidered.

3.5.6 Distribution of Questionnaire

Initially 20 questionnaires were distributed and 13 of the questionnaires were returned which gave a 65% return rate. Using snowball sampling the initial respondents were asked to pass on the questionnaires to their acquaintances via the internet to people with a knowledge of collaboration. A total of 52 responses was obtained. The pilot study questionnaire was originally written in Excel and they had to mark the correct box. When the final questionnaire was designed a survey website was used which made the process quicker. Respondents had to tick the box of choice. The programme also indicated how many more questions they would be asked to complete. This questionnaire was distributed via email to people known to have worked on collaborative projects and they then sent the email on to their contacts. The questionnaire contained questions to check their suitability as a Respondent. Any questionnaires in which the Respondent had a lack of experience or had not answered all the questions were discarded.

3.5.7 Final Questionnaire

The interviews resulted in a list of 48 aspects which Respondents in the questionnaire exercise were asked to rank. An example of how the questionnaire was set out is shown in Figure 11.

The questionnaire used a three point Likert Scale and asked the participants to decide if each individual aspect was either essential to collaboration, desirable, or nice to have but not necessary (see Appendix 14). This was a closed form of questioning. The Likert Scale was chosen for the questionnaire as analysis was made easier if the Respondents were not answering freely and their opinions could be directly compared. At the end of the questionnaire there was an opportunity to offer more possible aspects. The data once collected were then analysed by scoring each answer so that a rank order of the aspects could be produced.

5. The client takes the lead in the project.		
☐ Essential to collaboration	☐ Desirable for collaboration	☐ Nice to have but not necessary in a collaborative project
6. The contract supports collaboration.		
☐ Essential to collaboration	☐ Desirable for collaboration	☐ Nice to have but not necessary in a collaborative project
7. Accounts are accessible to both the contractor and the client.		
☐ Essential to collaboration	☐ Desirable for collaboration	☐ Nice to have but not necessary in a collaborative project

Figure 11. Example of questionnaire

3.6 ESSENTIAL ASPECTS AND PRODUCTION OF DEFINITIONS

The questionnaire scores were tested statistically to make a judgement on whether the scores could be used to determine whether the aspect is essential or not. The data were analysed using Spearman's Rho to check the validity of the results. Spearman's Rho tests the extent to which pairs of related data change together (Coolican, 2009). The data were also checked using Cronbach's Alpha to check the internal validity of the data. Cronbach's Alpha tests reliability by examining how much people vary on individual items (Coolican, 2009).

3.6.1 Essential Aspects

Having proved the validity of the data the scores were used to identify if the aspect was essential, desirable, or nice to have. For the next stage of the research only the essential aspects were examined. This was to keep the model manageable as a practical model.

3.6.2 Patterns in the Data

Pearson's correlation was carried out on the data to examine if there were patterns in the data. Pearson's correlation is a measure of co-variation. If variation exists in the data it can be positive (as one value increases so does the other) or negative (as one value increases the other decreases). Both these patterns were identified in the data and are examined in Chapter Six. These patterns were examined to aid in completing the model. The essential aspects were also divided into 'hard' and 'soft'. 'Hard' and 'soft' aspects would need to be handled differently within the model.

Further statistical analysis was carried out with ANOVA tests to identify any statistical differences in the means. Differences in the means between different groups of Respondents would indicate that these groups interpret collaboration differently. Analysis examined corporate affinity, years' experience and role. This analysis identified if different groups of people have a different interpretation of collaboration.

3.6.3 Definitions

The essential aspects were examined according to corporate affinity, experience and role to produce definitions relevant to the particular group but also an overall definition for collaboration was produced using the essential aspects. This was because no contemporary relevant definitions was identified by the Author in the literature.

3.7 GENERATION OF A MODEL FOR COLLABORATION

Once the list of 18 essential aspects had been derived the focus of the research proceeded to order them into a usable model. In order to produce the model, the Author needed to identify 'elements' that make up each of the essential aspects, the 'elements' being the 'who', 'when' and 'how'. As shown below in Figure 12.

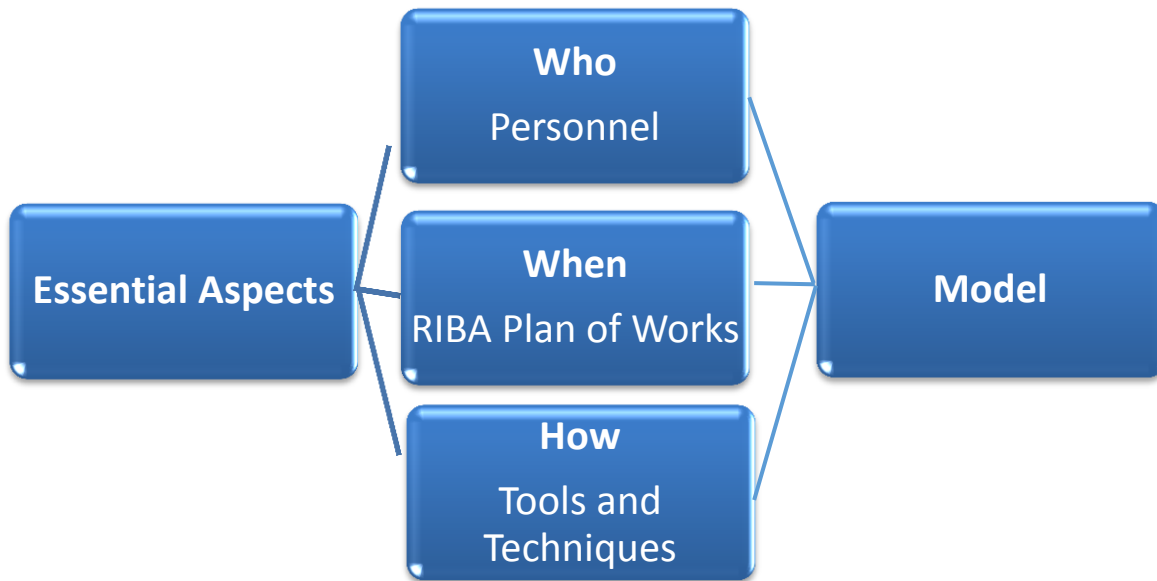


Figure 12. 'Elements' for model of collaboration

3.7.1 Writing the Model for Collaboration

The generation of the model focussed on three elements:

- Time – When – At what point in the project should the 'aspect' or 'element' be considered.
- People – Who – should be involved or control the 'aspect' or 'element'.
- Tools / Techniques – How – What tools and techniques should be utilised to achieve each 'aspect'.

The Author felt that these three pieces of information were required for Personnel to fully understand what is required of them to improve collaboration.

3.7.1.1 Timeframe

The RIBA Plan of Work (RIBA, 2013) was used as the time framework for the model. Although it was considered more relevant to building projects than civil engineering projects the process is generally understood by everyone in the construction industry. When personnel/tools and techniques should be involved was not always very clear in the literature and so the Author had to interpret this at times.

3.7.1.2 *Personnel involvement*

Which personnel should be involved was not always very clear in the literature and so the Author had to interpret this at times. The interpretation was then tested during the validation of the Author's initial draft model.

3.7.1.3 *Tools and techniques*

The tools and techniques identified from the literature should be able to promote, support, underpin and/or maintain the particular aspect of collaboration during the project process.

3.7.2 *Identification of the 'Elements' for Incorporation in the 'Model for Collaboration'*

The 18 essential aspects of collaboration were used to create the model.

The Author chose to use as much information published by the industry as possible. This would produce a model that the industry could identify with. Secondary sources were used to identify who should be involved with each aspect as well as the tools and techniques that may aid or improve each aspect of collaboration. The aspects were then related to the phase of the RIBA Plan of Work 2013 to provide the order of when they should be carried out. Each aspect was dealt with individually to ensure that data, if present in the literature, were incorporated into the model. Chapter Seven (section 7.3) shows the results of the information taken from the literature and used to inform the model.

3.7.2.1 *Sources of data for literature and information searches*

Initially the Author went back to the journal papers and searched for research papers on the essential aspects. A web based literature search was carried out using the e-library databases. Databases like Emerald were searched using specific terms from the eighteen essential aspects. However, Emerald did not yield the required information from the construction and business journal papers. The strategy was therefore reviewed and instead the Construction Information Service used for government

publications and similar documents specifically on the application of collaboration. These searches yielded more practical information relevant to producing the model.

3.7.2.2 The classification of information from the literature review

The literature review described in Chapter Two reviews 'what' collaboration is and 'why' it is important. The data required from the literature for the model was the 'who', 'when' and 'how' for each of the 18 essential aspects. 'Where' is addressed through the type of project. These data could then be used to inform the model.

3.7.3 Filling in the Literature Gaps

The literature did not contain all the information required to complete a model as described in Chapters Seven and Eight (sections 7.3 and 8.2.1). The initial interviews (phase one) had yielded a lot of information useful to the model. The transcripts were re-examined specifically for the time, personnel, and tools and techniques required for the model. This information, in conjunction with the literature, provided sufficient information to produce the model.

3.7.4 Assumptions Made Within the Model for Collaboration

While defining the model certain assumptions had to be made. One assumption was the type of project that the model was written for. The model could not be designed to cover every situation and so the Author designed the model for large complex projects involving a large team with early involvement of Contractor, Subcontractors and Suppliers. This early involvement can potentially bring about savings by the Contractor as well as the main Subcontractors and Suppliers. In smaller less complex projects bringing the supply chain on board may not make enough savings to warrant the outlay and therefore should be dealt with later in the collaborative project. Once written the model was distributed for validation. The Author had recognised from an earlier stage the need for validation of the initial draft of the collaborative model by key industry stakeholders.

3.8 VALIDATING THE COLLABORATIVE MODEL

With an initial model prepared it needed to be validated by suitably qualified people.

3.8.1 The Interviewee Sample Selection

The model needed to be validated by people with sufficient knowledge of the subject to make informed judgements. The model was designed for larger more complex projects and so the Interviewees needed to have worked on these types of projects. The model was written to apply to both building and civil engineering projects and so Interviewees from both sectors were interviewed. Targeted sampling from larger projects therefore took place to get the experienced Respondents that were required. Again, Constructing Excellence Wales provided contacts that had broad experience on collaboration around the UK. These people were a different sample to the sample used to help inform the model. The projects they were involved with were also different projects to the sample. This increased the sample and gave Interviewees a chance to disagree. This design was chosen to improve the replicability or generalisability of the results. The Interviewees that inputted into the model agreed closely with the Interviewees that were judging the model. This indicated the reliability of the model produced.

It was initially decided to interview five personnel that had worked on large complex collaboration projects, two from civil engineering and two from building. The fifth Interviewee was to be as neutral as possible in that they did not work for the Client or Contractor but in an advisory role. To get a broad spectrum of responses as well, of the two Civil Engineer Respondents' one represented the Client while the other represented the Contractor. This approach was the same for the building sector Interviewees. If the sort of comments these Interviewees made were similar then no further Interviewees would be sought. The experience of the Interviewees needed to be sufficient to make the required judgements and so Interviewees were sought via Constructing Excellence Wales from award winning demonstration collaboration projects.

3.8.2 Willingness and Availability to be Interviewed

Due to the fact that the Interviewees were involved in the Constructing Excellence Wales demonstration projects they were approachable and willing to be interviewed.

The Interviewees were busy people but by the Author agreeing to interview them at their place of work at a time to suit them meant that it was possible to achieve the

required interviews. It did however take a period of two months to complete the required interviews.

3.8.3 Interview Questions

The interview structure was quite open. They were asked to focus however on the time, techniques and personnel within the model.

The Interviewees were asked about their experience to confirm their suitability. They were then asked general questions about the model with regards to the time frame, personnel and readability.

A few general open ended questions were used with the Interviewees. The questions were:-

- Do you feel the correct personnel are involved?
- Do you feel the correct tools are being used or can you suggest others?
- Is the timing of the personnel and tools correct?
- The Interviewees were asked, subject to the changes being made, if they felt that the model was of use to the industry.

3.8.4 Interview Structure

The Interviewees were given the freedom to talk about the model as they wished to. They were prompted if they had not commented on the three main questions for each of the aspects. Otherwise they were allowed to guide the interview with prompting questions utilised if they strayed too far from the general topic. All the interviews were recorded and transcribed later.

3.8.5 Accessibility of the Model for Collaboration

The model was initially scripted to be read aspect by aspect which was how it was viewed by the Interviewees for validation. After the Author's validation exercise the model was also presented from two other perspectives, first by the RIBA phases and second by role, for ease of use by people in the industry.

For ease of access the model was published on a website so that people could access the information they required in the format that suited them.

3.9 VALIDITY

Validity for quantitative research is well established. The quantitative data collected for this research were analysed with Cronbach's Alpha. Cronbach's Alpha is the most widely used reliability coefficient (Knight and Ruddock 2008). The test examines how much people vary on individual items (Coolican, 2009).

Qualitative research validity is not established. Cohen *et al* (2011) describes the five kinds of qualitative validity:

- descriptive validity
- interpretive validity
- theoretical validity
- generalisability
- evaluative validity

Descriptive validity is the factual accuracy of the research (Cohen *et al*, 2011). The interview transcripts are provided as an audit trail in the Appendices (15 and 32) to support the descriptive validity.

Interpretive validity is catching the correct meanings (Cohen *et al*, 2011). The interviews were transcribed then checked for accuracy. The transcribed interviews were then coded. As part of the coding process previous codes were checked to ensure codes are not repeated. The coding was also checked at the end to make sure everything was coded correctly.

Theoretical validity is the theoretical constructions brought to the research by the Researcher (Cohen *et al*, 2011). The research was examined and then the data compared and contrasted to the theory. Having examined the theory first it forms a framework for the researcher's views.

Generalisability is a measure of how applicable the research is to similar situations (Cohen *et al*, 2011). Generalisability has been an important focus during the research and several strategies have been utilized to improve it. Constructing Excellence Wales was approached for selective sampling which reduces generalizability. However

through snowball sampling generalisability was improved. Triangulation was utilised by testing the results from interviews about collaboration through the use of the questionnaire. Finally, through each phase of the research, different Interviewees/Respondents were used to increase input into the final model.

Evaluative validity is the taking of a judgmental stance towards research (Cohen *et al*, 2011). The process of writing the thesis has been important as it allows the Author to stand back and evaluate the research and the research methodology. The Author has also published two conference papers and one journal paper on this research which supports the external validity of the research.

3.10 CONTRIBUTION TO KNOWLEDGE

The aim was to contribute to knowledge by producing a list of aspects that are perceived by the industry as important within current collaborative construction projects. By rank ordering these aspects it was possible to identify the essential aspects to collaboration. These essential aspects were used to define what collaboration is within the UK construction industry and also to produce a model to aid the process of collaboration. This model aims to be a practical model to improve the success of collaborative projects within the UK construction industry.

3.11 SUMMARY

This chapter has initially examined the theory of research methodology in order to set out alternative research approaches. Utilising this information the research design was chosen. The design utilised a mixed methods approach coming from a pragmatic ontology with a sequential mixed methods strategy of inquiry. The Author used open ended interviews and closed ended questions within the questionnaire as the research methods.

The chapter described how the research design allowed the aims and objectives to be achieved through primary research to gather qualitative data through the use of interviews. This allowed exploration of the meaning of the term 'collaboration'. The list of aspects produced could be rank ordered. A closed ended questionnaire asked

personnel to rank order the aspects using a Likert Scale so that the aspects could be compared to each other.

The 'elements' of which personnel (who), what tools and techniques (what) and at what point in the project personnel should be involved (when) were identified for the 18 essential aspects. The literature was utilised to identify 'elements' that the industry are using to promote/control the 'essential' aspects. The essential aspects were then used to produce a model that could be used to achieve successful collaborative construction projects. The model was trialled with people from the industry to test its validity. Finally the model would be published on a website to improve usability through different search methods.

The chapter concludes by examining the contribution to knowledge which is discussed further in Chapter Ten, section 10.15. The next chapter sets out the primary data collected on the aspects to collaboration from a series of interviews. The results of the interviews are then compared to the literature. This identifies how the current interpretation of collaboration in the industry differs from the term "partnering" in the literature.

Summary of Chapter Three

1. Review of philosophical worldview and justification of choices taken.

- The post-positivism, social-constructivism, advocacy and pragmatic research philosophies have been reviewed. A pragmatic approach has been adopted and the reasoning for this presented.

2. Presentation of the research strategy followed in the study.

- A mixed methods design has been presented and justified. The validity and generalisability techniques such as triangulation and statistical analysis have been explained and justified.

3. Presentation and justification of the research methods utilised in the study.

- Interviews and questionnaires have been discussed including strengths and weaknesses of these techniques. The reasoning behind the production of the model has been presented.

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