

# PHD IN CONSTRUCTION MANAGEMENT RESEARCH: WHAT IS ORIGINAL CONTRIBUTION TO KNOWLEDGE? THE CASE OF TQM.

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The ultimate test of any PhD is how it contributes to knowledge. However, other criterion must still be met in order to satisfy the requirements of a PhD in Construction Management. In order to demonstrate the process undertaken towards contribution, this paper highlights the two steps of the research process that were utilised, the positivist and phenomenological approaches as two distinct methodologies. The aims of the paper are two fold. First to highlight the general requirements of meeting the PhD criteria in Construction Management research, and second, to match the specific criteria of contribution to knowledge with illustrative examples by exploring the application and theory development. Using the topic of 'Total Quality Management' in the fields of 'Operations Management' and 'Construction Management' as prime examples, the research undertaken and contribution made in achieving in obtaining the PhD are presented. Examples of the required criteria are illustrated. This paper can be of benefit to researchers in the writing up phase of the PhD in clarifying what constitutes the contribution to knowledge

**Keywords:** Construction Management, Knowledge, Research Methodology, PhD research, TQM.

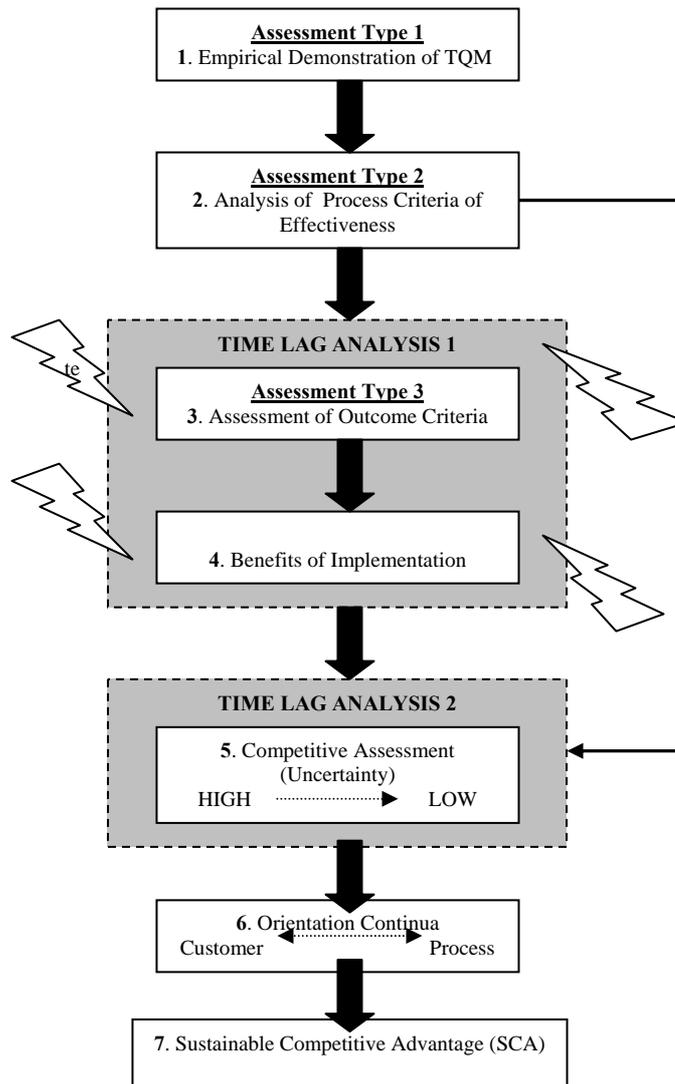
## INTRODUCTION

Mukhejee et al (2002) observe that a PhD degree implies that the researcher has attained an acceptable level of knowledge and research expertise. Within the Author's institution (2004), the PhD is awarded to candidates who having critically investigated and evaluated an approved topic, resulting in an independent and original contribution to knowledge, and demonstrated an understanding of research methods appropriate to the chosen field, has presented and defended a thesis by oral examination to the satisfaction of the examiners. In terms of selection of the research area, this was never questionable because the issue of Quality Assurance had been tackled at the industrial experience and MSc level; however, the PhD was another ball game. Drawing heavily on an approach by Kekale (2001), "It was easy to decide what to write about; the real problem was rather, how to write"?. The focus of this paper is mainly on the issues of what constitutes 'an independent and original contribution to knowledge'. The paper is structured as follows, first the conceptual framework underlying the study is presented, second, the criteria for meeting the PhD thesis is provided, thirdly the matching of the said criteria of contribution to the three pillars of knowledge are presented. Finally, the contribution to knowledge through the application and theory development of Quality Management is highlighted through the following phases of discovery, mapping, relationship building and theory validation purposes.

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## CONCEPTUAL FRAMEWORK OF THE SURVEY STUDY



**Figure 1.0:** Conceptual Framework for the Survey Study

The framework illustrated in Figure 1.0 covers attitudes and perceptions of TQM. It also sums up the contents of the survey document used for the quantitative analysis and seeks to measure and assess the TQM activities and outcomes. In order to demonstrate what entails "Contribution to Knowledge", it is necessary to present the conceptual framework for the survey study so that reference could be made to the originating source, and how the theory developed (if any) relates to the type of data sought and collected. Based on Hackman and Wageman (1995), they suggest that in order to effectively measure and assess the TQM activities and outcomes, a fully fledged evaluation of a TQM program should include the three distinct types of assessment. These are shown in boxes 1 through 3 of Figure 1.0 and are as follows;

1. Empirical demonstration of TQM has in fact been implemented, and confirmation that it is TQM that is being assessed;
2. Analysis of Process Criteria Effectiveness, and
3. Assessment of Outcome Criteria

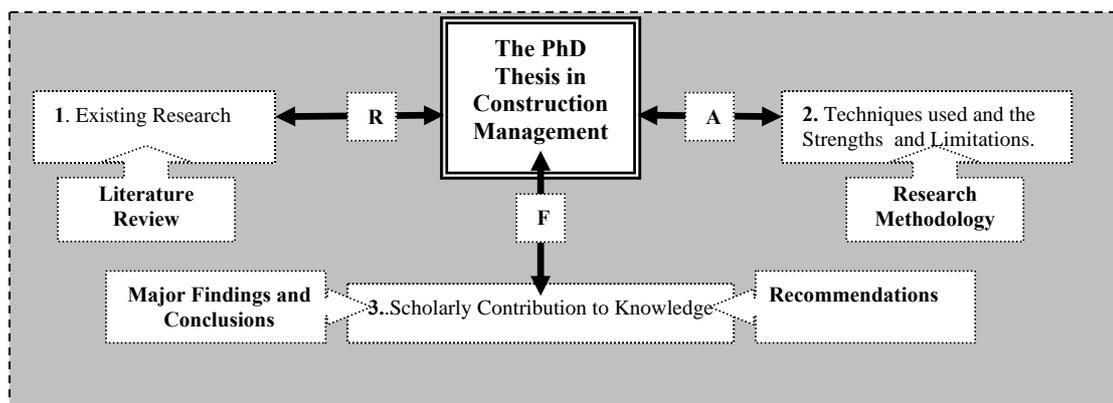
These have the following purposes respectively;

1. To confirm that it is TQM that is being assessed rather than, for example some subject of the integrated TQM package such as BPR, Six Sigma etc.
2. To determine whether TQM alters how people work together to meet customer requirements
3. The degree to which improvements in bottom line organisational effectiveness are found

The whole research hinged upon conducting the three types of assessment and the survey document was designed towards achieving the stated assessment. However as noted by Hackman and Wageman (1995), in order to conduct the three distinct types of assessment entails the usage of different methods and analytical strategies. Furthermore, they are problems encountered in ascertaining the assessment of the outcome criteria. This leads to "time lag analysis 1" indicated in the first shaded box of Figure 1.0 which covers objective 3 and 4 of the survey document. These problems are indicated in form of the symbols for "flashes" or "lightening" implying interference. These are 1) Measurement (me) problems associated with even standard indices of firm performance, 2) Exogenous (ex) disturbances and 3) Temporal issues. The second type of "time lag analysis 2" relates to the impact of the competitive assessment which borders on the orientation and uncertainty (Reed et al, 1996). Having presented the overall conceptual framework for the survey study, the next section will link the requirements of the PhD Thesis in Construction Management to Figure 1.0

## CRITERIA FOR PHD THESIS

In addition to the scholarly contribution to knowledge, the PhD thesis needs to indicate the clear relations with existing research and shows an awareness of the research methodology. The three stated criteria are captured in the form of a diagram in Figure 2.0 showing the inter-connectivity with associated potential chapters. For ease of clarity, this is referred to as the "RAF Approach".



The three main criteria for a PhD Thesis are;

1. **Relationships** with existing research
2. **Awareness** of techniques used and the strength and limitations

3. **Findings** which constitute a scholarly contribution to knowledge. These are based on the three pillars of observation, induction and deduction. There must be findings within the thesis which constitute a contribution.

### 1. Relationship with Existing Research

As stated by Price (2004), the student and supervisor must agree on (1) and (2) of the criteria in the early stages through the initial ideal or field of research and research methodology. Furthermore, Hughes (2003) provides useful tips on how to achieve and meet this criteria. The daunting task is obviously in matching the (3) criteria. In achieving the first criteria, extensive literature research helped establish what the research gap could be. In particular, Sousa and Voss (2002) organised and reviewed Quality Management research in the following first five key areas as shown in Table 1.0 (Column 2).

Another requirement can be that of weakness identified. In providing the justification for research as shown in Table 1.0 (Column 4), potential PhD students must consider the following:

1. importance of the specific area (SME's in Construction)
2. relative neglect of the research problem by previous research
3. relative neglect of the research's methodologies by previous researchers
4. usefulness of potential applications of research's findings.

Therefore, achieving and meeting the first criteria would always not be a problem provided the candidate demonstrated the relationship with existing research.

**Table 1.0:** Summary of Research Gap Identification (For Illustrative Purposes)

No.	Relationship with Existing Research (1-5 : Sousa and Voss, 2002) (5: Hackman and Wageman, 1995) (6: Reed et al 1996) (7: Hendricks and Singhal, 2001; Taylor and Wright, 2003)	Industry and Area of Application, Size of Firm	Weakness Identified (Potential Research Gap) * Justification for the Research*
1	2	3	4
1	the definition of quality management	1. Manufacturing and Service Oriented Literature. 2. Focussed on Large Organisations. 3. Quality Measurement Instruments mostly tested in Service and Manufacturing Industries	1.Potential for Construction Industry 2. Particularly SMEs. 3. Testing of Applicability in (1) & (2) ? 4. Selection of Instruments 5. Focus on "Content" than "Process" ?
2	the definition of product quality		
3	the impact of quality management on firm performance		
4	quality management in the context of management theory		
5	implementation of quality management		
6	Benefits of TQM and Time lag Analysis	4. Factors set for Large Organisations	6. Potential for Orientation-Uncertainty Matrix ?
7	Impact of Organisation Size, Age and Environmental Factors on TQM	5. Manufacturing and Large Organisations	7. Contribution to Time Lag in SMEs and Contextual factors

## 2. Techniques used and the Strengths and Limitation

The merits and demerits of the two distinct methodologies, namely the positivist and phenomenological approaches were utilised. One of the criteria of a PhD thesis is the need to demonstrate a disciplined attack on a determinate problem using appropriate methodology, as such, there is a need for awareness on the basis of techniques used and strengths and limitation to the issue in hand to be demonstrated. Chapter two of Chileshe (2004) provided the detailed methodology in striving to achieve the stated criteria. As pointed out by Hughes (2003), one of the chapters or main section of the literature chapter should cover literature on research methods. Hughes (2003) states that the thesis should be a self-contained, internally consistent and persuasive document. The question then is how to achieve that. The methodology section of Chileshe (2004) formed the bulk of the thesis as the statistical methods to be used were detailed in great depth. It can be argued that the PhD thesis is an assessment document, therefore the evidence for the statistical analysis together with its description of the process was outlined and explained in great detail. Furthermore it is suggested that examples of analysis helps serve the "awareness of the basis of techniques", an example of the methodological issues is shown in Table 2.0.

**Table 2.0:** Summary of Methodological Issues: Data Analysis

No.	Existing unanswered questions both on the conceptual and empirical lines (Filippini, 1997)	Commonly Used Data Analysis	Potential Areas Identified and Utilised
1	The components of total quality and their measurement	<b>1.0 Descriptive Statistics</b> 1.1 Means 1.2 Ranking 2.0 Frequencies 3.0 Correlation 4.0 Multiple Regression	1. Structural Equation Modelling (SEM)
2	Relations between variables and concepts		
3	The impact of different practices on performance		
4	Conditions under which various interventions can be applied and their effects		

## SUMMARY OF FINDINGS WHICH CONSTITUTED AS A SCHOLARLY CONTRIBUTION TO KNOWLEDGE

- **Transferability and Applicability of Instruments within the Construction SME's**

The major contribution of this research, is the transferability and applicability of the implementation construct from manufacturing and service to the specific construction settings. It was unique in the sense that a non-construction model has been utilised and validated, therefore, confirming the external validity. The second was the confirmation in the UK Construction Industry of results previously obtained in other industries such as Manufacturing and Service Industries.

- **Organisation Size and the Implementation of TQM**

By finding support for a direct relationship between organisation size and the implementation of TQM, the study is contributing to the debates about the effects of organisation size on TQM to the somewhat mixed findings. Furthermore, the lessons to be learnt by SMEs are that as they move from the micro/small status to the medium status, they need to re-align their organisation strategy.

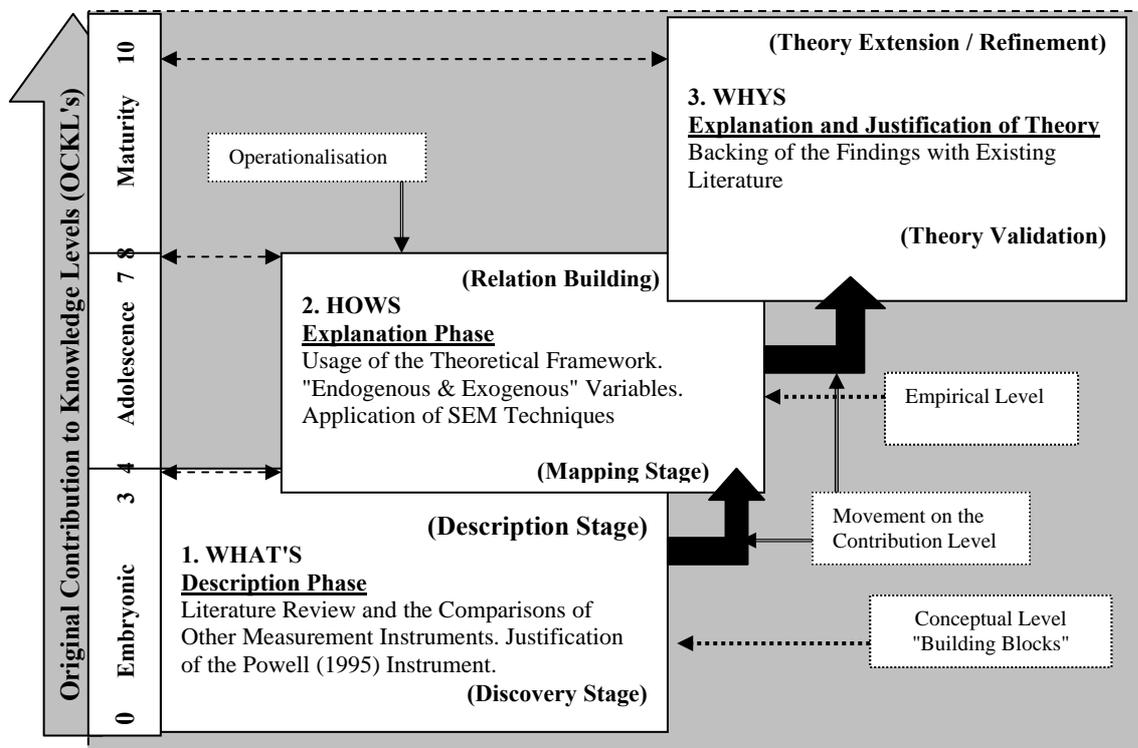
- **Maintaining the Convergent and Discriminant Validity of QM**

One area found wanting in TQM research, that is the difficulty at arriving at a theory which highlights the various concepts of TQM by measuring them and then correlating these concepts to quality performance. The TQ-SMART achieves this through the application of Advanced Structural Equation Modelling techniques as advocated by Williams et al (2003). This research contributes to TQM knowledge by maintaining the convergent and discriminant validity of Quality Management. This extends the work of Hackman and Wageman (1995) that raised the following question; "Is there such a thing as TQM"?. In assessing the distinctiveness of TQM, the two comparison groups were considered, TQM and non-TQM deploying UK Construction related SMEs, however, as foreseen by Hackman and Wageman (1995), despite passing the discriminant validity test, TQM is close to failing the test when one considers emerging initiatives as identified in this study, by organisations which claim not to be TQM yet, address some principles of TQM. The case studies also provide evidence of different initiatives such as 'Business Improvement Teams', 'Business Re-Engineering'

### MATCHING CRITERIA OF CONTRIBUTION TO KNOWLEDGE

Handfield and Melnyk (1998) state that scientific knowledge must provide one of the following five objectives; **A method** of organizing and categorising 'things' (a typology), **Predictions** of future events, **Explanations** of past events, **A sense of understanding** about causes events, and in some cases the potential for **control** of events. Anon, (1994) describe a contribution as a change to a body of knowledge created by a research project

The three levels of development shown in Figure 3.0 are defined briefly as follows



**Figure 3.0:** Author's Interpretation of the Handfield and Melnyk, (1998) " Process and TQM Perspective" Steps in the Development of Empirical Theory

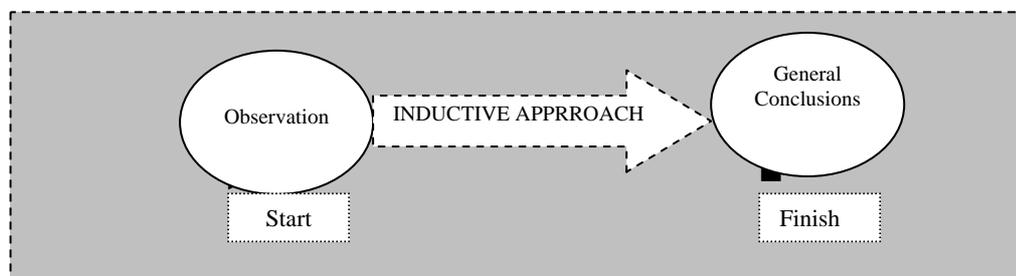
**1. Description Phase** - The conceptual "building blocks": This allows the elements that are of interest to be characterised. Exploratory research based on the descriptive statistics is useful in this phase. Ordóñez de Pablos (2004) observed in citing Hulland (1999) that the conceptual level is important as a prelude to the commencement of the causal modelling process. Filippini (1997) argues further that the description phase allows the elements that are of interest, to be characterised. As demonstrated by Llewelyn (2003), the concepts in the first stage theorise through explicating practice, they create meaning and significance through linking the subjective and objective realms of experience.

## ORIGINAL CONTRIBUTION TO KNOWLEDGE LEVELS

**2. EXPLANATION PHASE** - Empirical Level: This entails the construction of a framework which defines and justifies the relationship between the variable. According to Filippini (1997), this phase is often neglected in Operations Management studies where a complex phenomenon has been simplified and solved with an algorithmic model, thus ignoring important aspects of the real world. The inference being that the moderating effects are not taken into account. To avoid the identified pitfalls, three methods were considered for the analysis of the moderating effects. These are splitting the sample, hierarchical moderated regressions and structural equation modelling. The data analysis section of the thesis (Chileshe, 2004) provided a detailed explanation of each of the three methods and this study used them to ascertain the moderating effects.

### Induction as a Pillar of Knowledge

The inductive approach whose focus is theory building can be illustrated in the following Figure 4.0. As elaborated by Vignali and Zundel (2003), induction contains the extrapolation from the data insights into human behaviour.



**Figure 4.0:** Induction as a Pillar of Knowledge

This process is also referred to as grounded theory because it is grounded and it has its specific observation of social life. (Vignali and Zundel, 2003:207). This called for reasoning from particular experiences to general truths, and the case study

methodology was particularly useful in demonstrating the pillar of knowledge, namely induction. Through the triangulated research methodology and the cross case analysis, new insights were gained, particularly concerning the differences between TQM and non-TQM deploying organisations. This in turn helped achieve objective 3 which was to 'determine if there are any differences in quality management implementation and quality outcomes across UK construction-related SMEs. If so, how and why they differ'. Evidence or **Findings** also emerged of TQM giving way to different quality initiatives such as Business Process Re-Engineering (BRP), Six-Sigma and over reliance of the EFQM Excellence Model as the "de facto" TQM.

Observation as a Pillar of Knowledge

Phase 1 can be equated to the conceptual level which is the process step of observation, and whose purpose is "discovery". Typical questions at this stage were; what is going on?, Is it interesting enough to research? In order to achieve and complete the description phase, the first and second objectives were "to identify the major constructs of Total Quality Management (TQM) and refine the scales for measuring the constructs" and "to review and evaluate validated instruments used to measure Quality Management within the Manufacturing and Services Industries".

Literature review was the key data collection method in the comparisons of the measurement instruments. The critical factors as propagated by various authors and backed by the Quality gurus such as Crosby, Juran and Deming were examined from the theoretical perspective. The instrument as revised in the Discovery stage of Figure 3.0 is reported in an earlier study by Chileshe and Watson (2004). This enabled the collection of data from the UK Constructional-Related SMEs in order to address the extent of deployment of the ten critical success factors as demonstrated in Figure 1.0.

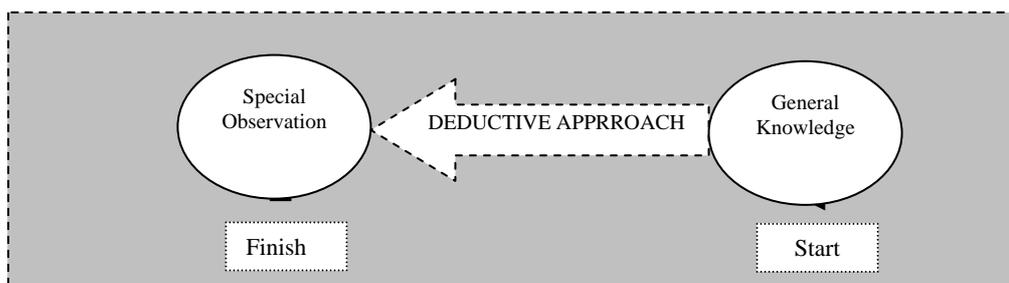
In terms of satisfying the third criteria of the PhD, any demonstration of movement on the OCKL would suffice.

Through the descriptive statistics such as the mean, standard deviation and median presented in the data analysis section regarding the TQM deployment constructs, discovery of data relating to the application of TQM within SMEs was achieved. However, however although this could not be used to compare the levels of different categories, it did provide the opportunity to rank the data and therefore, was adequate for this purpose.

As argued by Forza (2002:155), descriptive survey is aimed at understanding the relevance of a certain phenomena, in this case being TQM and describing the distribution of the phenomena in a population, being the Construction Industry. The attributes of the UK Constructional related SMEs in generalizing observations were considered for possible effects of organisation size. Handfield and Melynk (1998) recommend such effects in setting boundary assumptions on the observation. This led to the classification of the sample into small-sized and medium sized, and also formed the basis of output area of contribution to knowledge through 'taxonomies and typologies'.

### Deduction as a Pillar of Knowledge

The second pillar is known as deduction which involves the "how's" and can be represented in diagram form, thus providing a visual aid for the interpretation and development of theory. Deduction as illustrated in Figure 5.0 has the purpose of explanatory theory testing. This describes the movement from the model to a solution in either symbolic or numerical form. Such procedures are supplied by mathematics.



**Figure 5.0:** Deduction as a Pillar of Knowledge - Quantitative Research

Typical questions at this stage were; What is here? What are the key issues? What is happening?

The move from the discovery stage to that of description on the arbitrary scale of (0→3) on the **OCKL** in Figure 3.0 was demonstrated through the third objective of the study, which was "to determine if there are any differences in quality management implementation and quality outcomes across UK Construction-Related SMEs. If so, how and why they differ".

Issues considered at this stage were the contextual factors such as organisation size, union density and TQM maturity. Although such issues are addressed in literature as shown in Table 1.0, from the contribution to knowledge point of view, there was scope as studies on impact of organisational size and TQM maturity presented mixed findings, with the main two schools of thought being the fact that there would be a difference between early adopters and late adopters (i.e. Powell 1995; Taylor and Wright 2003; and Reed et al 1996). The other school claiming that there is no difference between early adopters and late adopters, According to Taylor (1997). While some studies find support for a correlation between organisation size and TQM implementation, in contrast several studies have failed to find support for a direct relationship between organisation size and implementation of TQM. Therefore, the key question was to demonstrate or present findings on whether organisation size impedes the implementation of TQM, secondly whether the differences in Quality Management could be attributed to the maturity of the TQM or any quality initiative and thirdly, whether union density affected the overall TQM implementation process. The approach undertaken in the data analysis is described in detail in Chileshe (2004), and also presented as conference papers (Chileshe and Watson, 2005a; 2005b; 2005c; 2005d)

## COMPONENTS OF THEORY

Wacker (1998) identified the need for the components of theory to meet the following criteria; 'Not wrong', Causality, Falsifiability and Parsimony. "**Not wrong**": Care was taken to ensure that the research methodology used in this study was appropriate. This involved matching the research problem with the appropriate data analysis mechanism as stated by Handfield and Melynk (1998). Sufficient data is provided throughout the thesis and appendices to ensure that the 'correctness' of such indicators as degrees of freedom (df) or the *p*-statistics or standard errors can be accepted. "**Parsimony**" introduces its own set of challenges. This is demonstrated through the thesis by using the few variables as a result of refining the measurement instrument, and yet, being able to explain the events or outcome of interest. This supplementary criteria lies at the following assumption that the fewer the better. According to the Wacker (1998) theory there should be four basic criteria:

1. **Conceptual definitions** - terms of variables of the ten deployment constructs and four scales of Business and Organisation Performance indicators as provided for in the literature review.
2. **Domain limitation** - where the theory applies, this case being the UK Construction-related SMEs.
3. **A Set of Relationships** of variables which can be illustrated in the structural equation modelling format for the TQM deployment constructs and for the Business and Organisation Performance Indicators. (See Chileshe, 2005a)

4. **Specific predictions (factual claims)** - This could be equated to TQ-SMART and its associated Business and Organisation Performance Indicators, and was based on three pillars of knowledge namely, "observation, induction and deduction".

Kelly (2004) used a similar approach in the hypothetical (Jaykay research diagram) illustration at the undergraduate or masters dissertation of the four basic criteria and proposed a four level classification structure comprising conceptual framework, theoretical framework, technical framework and technical analysis. This study has demonstrated the specific application of the levels in theory development to the research as undertaken in the area of "Quality Management" at the PhD Level.

## CONCLUSIONS

The paper also highlighted the potential other areas of contribution to knowledge in Construction Management research. By matching the research strategy with theory building activities as articulated by Handfield and Melnyk (1998), the paper demonstrated how the movement on the **OCKL** (Figure 3.0) can be achieved. As opposed to the current bias and stagnation of Construction Management research in the discovery stage levels (0-3), slight movements through the adolescence and maturity stages are plausible. Therefore, this study extends the work of Dale et al (2001) by demonstrating that total quality management research has moved on from the early stage (embryonic) as illustrated in Figure 3.0 to Adolescence stages of theory development. This study has also demonstrated the application of the three pillars of knowledge to the study. Equally, the implications of the positivism paradigm of Independence, value freedom, causality, hypothetical-deductive, operationalisation, reductionism, generalisation and cross-sectional analysis are demonstrated throughout the research.

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