METHODOLOGICAL APPROACH OF CONSTRUCTION BUSINESSES FAILURE PREDICTION STUDIES: A REVIEW

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In an attempt to stem the tide of mass failure of construction businesses, or support financiers and clients in identifying healthy construction firms for loans and contracts respectively, many researchers have developed construction industry bankruptcy prediction models (CI-BPMs). The effectiveness of such CI-BPMs is partly dependent on the methodology used in building it. Despite the usual claim of high accuracy by developers/authors, none of the CI-BPMs developed has gained wide acceptance in the construction industry, leading to development of new ones in succession. This study hence reviews the methodological positions in CI-BPM studies using the complete available population. After a critical content analysis of the features of CI-BPM studies, they all appeared to have used the positivism paradigm with realist ontology, objective epistemology and deductive approach. Although the main aim of CIBPM studies to 'predict' failure, an action (i.e. prediction) which is well ingrained in the positivism paradigm, makes the generally adopted positivism paradigm appear very appropriate, the aggressive dynamism of the construction industry and the experts' criticism of the methodology clearly makes it inappropriate. This work proposes pragmatism, in the methodological pluralism form, as the best paradigm for CI-BPM research with realist ontology, combined subjective and objective epistemology, mixed-method research choice, case study, archival and survey strategies, and the deductive research approach. A complete research design framework for executing the proposed methodology is presented.

Keywords: construction business failure, bankruptcy prediction models.

INTRODUCTION

As vital as the construction sector is to most countries' economy, construction businesses still fail in large numbers. The negative impact of such failures on economies, owners of failed businesses, financiers, clients and other stakeholders can be immense. One of the major ways of preventing construction business failures and ensuring financiers and client give loans and contracts respectively to only healthy firms is by using bankruptcy prediction models (BPMs) to reveal potential failure so that mitigation steps can be quickly taken. Many studies have thus justifiably attempted to build high performing BPMs. The performance of a BPM is however dependent on, among other factors, the methodological approach used to develop it.

Because of the nature of enquiry and expected result, and the positivist approach adopted by pioneering works in the BPM research area, virtually all construction industry BPM (CI-BPM) studies have taken the positivism stance. The very first work on BPM was done by Beaver (1966), an accountant, who investigated how financial ratios can be used to predict failure of firms. Beaver's aim in itself readily side-lined the subjects i.e. firms' employees or owners, and had everything to do with the objects i.e. firms, since financial ratios of firms can be easily sourced from third parties. Altman (1968) built on Beaver's work by using a multivariate analysis of ratios to predict failure. The nature of these two pioneering works, i.e. to predict, had clearly set the studies closer to the positivism paradigm (Trochim and Donnelly, 2006).

Most, if not all, CI-BPM studies (Mason and Harris, 1979; Langford *et al*; 1993; Abidali and Harris, 1995; Thomas *et al*., 2011; Chen, 2012; Bal *et al*., 2013; Horta and Camanho, 2013) that emerged arbitrarily used an approach similar to that of Altman (1968). In fact, no study made mention of its research paradigm or methodological positions l*et al*one justify them. With no CI-BPM gaining wide acceptance, new CI-BPM studies have continued to spring up with concentration on choosing more effective financial ratios and/or better prediction techniques seen as the required means of bettering the models; the improvement, whenever there is any, has however been insignificant (Balcaen and Ooghe 2006). With little or no progress in CI-BPM performance, this work aims to review and critique the paradigm and methodological positions taken in CI-BPM studies to explore possible methodological improvements. The following are the objectives of this study:

- To identify, discuss and critique the methodological positions taken in CI-BPM studies
- To identify any deficiencies and propose possible improvement(s) to the methodology for developing a valid CI-BPM

The next section explains the methodology used to execute this review. Next is a discussion on positivism as the main paradigm used in CI-BPM studies, followed by ontology and epistemology of study area. Section 4 discusses the implication of the prevailing methodological positions while section 5 proposes improved paradigm and methodology, before conclusions are given.

METHODOLOGY

This study uses the review research strategy to analyse existing literature in order to critique their methodological positions for potential improvement. The studies were explored using content analysis, which examines papers to systematically quantify content in terms of anticipated or pre-known classes (Bryman and Bell, 2007); the classes in this case being paradigm, ontology, epistemology and sometimes other methodological positions. The paradigms of the CI-BPM studies are established by highlighting their research features such as research aim, data collection method, data type, form of analysis etc. and presenting the paradigms that conform to these features. The review of various existing knowledge is a recognised way of contributing to the progression and expansion of knowledge (Aveyard, 2007). This is why it has been widely used as methodology in various research areas including insolvency prediction (Balcaen and Ooghe 2006) and construction business failures (Edum-Fotwe *et al*., 1996; Mahamid, 2012).

The unit of analysis in this paper are CI-BPM studies. The unit of analysis selected are unambiguous, abstruse and analysable knowledge according to the cognitive view (Akerhurst *et al*., 2011) most of which exude from construction-specific publication

sources like ICE, ASCE, etc. and business and finance publications through publishers such as Elsevier, Taylor and Francis, Emerald and Springer.

POSITIVISM AS THE MAIN PARADIGM OF CONSTRUCTION INDUSTRY BPM STUDIES

Majority of CI-BPM studies over the years (Mason and Harris, 1979; Langford *et al*; 1993; Abidali and Harris, 1995; Thomas *et al*., 2011; Chen, 2012; Bal *et al*., 2013; Horta and Camanho, 2013) seem to have used the positivism paradigm, though the selection is barely expressly stated and/or justified in any of the papers. In positivism, research is *"seen as the way to get at truth, to understand the world well enough so that we might predict and control it"* (Trochim and Donnelly, 2006, p.18). This is exactly what CI-BPM studies are usually about. In the studies, an attempt is made to understand construction business failures and to identify failure indicators; then there is effort to predict potential failure in order to aid control of the situation by owners taking mitigating steps, or financiers and client avoiding giving loans and contracts respectively to potentially failing construction firms. The aim of CI-BPM studies thus, to an extent, lend them to positivism.

Positivists believe that research can mainly be done by observations and measurements (Trochim and Donnelly, 2006). A positivist researcher whose approach *"is rooted in the tradition of sociological positivism"*, is normally independent (of the subject) as an observer, reduces a phenomenon to simpler measurable factors/ elements, explains the elements in terms of how they affect the phenomenon (cause and effect) and usually uses large samples (Burrell and Morgan, 1979, p.26; Saunders *et al*. 2009). All these features are normally exhibited in CI-BPM studies (Mason and Harris, 1979; Langford *et al*; 1993; Thomas *et al*., 2011; Chen, 2012; Bal *et al*., 2013). In these studies, a large number of construction firms are selected as sample, usually the larger the better; the complex failure process (phenomenon) is reduced to measurable variables, usually financial ratios (simpler elements); the ratios and the factors they measure are described; the financial ratios are finally analysed with a statistical technique which uses the measurement of the ratios of the firms to predict their potential failure/survival. A few indicative quotes from some of the studies are given in the next two paragraphs.

Abidali and Harris (1995, p.189) *"combines financial ratio analysis and the statistical technique known as multivariate discriminant analysis, to produce a predictive model made up of seven variables"*. The ratio of turnover to net assets *"measure of how well a company has used its productive capacity"* (Abidali and Harris 1995, p.191)

"Using financial ratios and the Altman Z-score modelling methodology, an insolvency warning model is developed in order to evaluate the performance of construction contractors in China" (Thomas *et al*., 2011, p.599). The Activity ratio measures *"how well a company has been using its resources"* (Thomas *et al*., 2011, p.601).

According to Burrell and Morgan (1979) the functionalist is always seeking to find implementable solutions to real problems and is more concerned with controlling social affairs. This is well in line with the aim of CI-BPM studies which try to provide BPM as a solution to the real problem of either high rate of construction businesses failure or to the problem of identifying healthy companies for loans or contract. CI-BPM studies have used mainly quantitative data, in form of financial ratios, which is common with positivists (Mukherji and Albon, 2009). Further, positivist tend to use

statistical analysis so as to aid generalization (Alvesson and Sköldberg, 2009; Mukherji and Albon, 2009); this is typical of CI-BPM studies as shown in the quotes.

From all the evidences given in this section, it appears that the positivism/ functionalism paradigm is predominant in the CI-BPM literature. This is well understandable since prediction, the main aim of the studies, is a main feature of positivism. Although critical realism also supports quantitative data and analysis, and possess some features similar to those of positivism, it is not used mainly for prediction. A critical realist is also not an independent observer, i.e. an objectivist, as is with CI-BPM researchers (see epistemology below). A brief look at the ontology and epistemology of the reviewed studies can shed more light on the discussion.

Ontology and Epistemology of Construction Industry BPM Studies

Ontology deals with the assumption researchers have on how knowledge exists i.e. 'nature of reality' (Saunders *et al.*, 2009, p.110) while epistemology deals with how to learn that reality (Krauss, 2005). The realist ontology and objective epistemology are features of positivism (Saunders *et al.*, 2009) and are thus the adopted forms in the positivism aligned CI-BPM studies. Realism *"assumes that social and natural reality exist independently of our cognitive structure: an extra-mental reality exists whether or not human beings can actually gain cognitive access to it"* (Johnson and Duberley, 2000, p.67). The realism ontology is in itself quite embedded in the nature of CI-BPM enquiries since the statistics of mass failure of construction businesses is repeatedly available in many financial and government reports; the failure is real whether or not human beings can access, assess, prevent or hasten it, or whether human beings know about it at all or not. This is pretty much the opposite of idealism ontology which *"assumes that what we take to be external social and natural reality is merely a creation of our consciousness and cognitions"* (Johnson and Duberley, 2000, p.67).

Epistemology wise, objectivism is the widely used option in CI-BPM studies. Objectivism accepts that reality and its meaning exists independent of any awareness or recognition and can be learned (Crotty, 1998); it focuses on the object with absolutely no regards for the subjects (Saunders and Paul, 2013). CI-BPM studies are generally directly concerned with only the object i.e. the construction firms. Developing the CI-BPMs is done, in virtually all cases, with absolutely no contact with the subject i.e. any representative of the sample construction firms (e.g. owner, employee, firm's lawyer etc.) The information used to develop the CI-BPMs is usually in form of financial variables that can be gotten from financial firms independent of the sample construction firms. In the very rare cases where non-financial variables are used, questionnaires are used to get the variables. The exclusive use of the objective approach in CI-BPM studies has however been an area where improvement can be made since it has always been an area of contention between experts, plus the construction industry is quite dynamic (see next section).

IMPLICATION OF THE NARROW METHODOLOGICAL POSITIONS IN CI-BPM STUDIESN

The restricted use of the positivist approach to CI-BPM studies has led to the continuous exclusive use of the objective epistemology, through the use of multivariate analysis of financial ratios. Unfortunately, this restricted approach does not fully represent the insolvency situation of construction firms as highlighted in various studies, also, due to the dynamism of the construction industry.

On facts highlighted in various studies, countless number of non-financial indications of insolvency, such as management mistakes, do come up a lot earlier than financial distress (Abidali and Harris, 1995). Financial distress only tends to be noticeable when the failure process is almost complete, around the last two years of failure according to Abidali and Harris (1995). In fact it is adverse managerial actions and other qualitative factors that lead to poor financial standings and in turn cause insolvency. Accordingly, many experts have reiterated that financial ratios alone are insufficient for early depiction of disastrous factors like shambolic management, acquisition of a failing construction firm, economic decline etc. (Abidali and Harris, 1995). Edmister (1972) and Argenti (1980) also stressed that financial ratio models are not enough to predict insolvency of construction firms until they are used with other economical, 'managerial and social factors'. Further, the tendency of accountants to amend important financial ratios, known as window dressing or creative accounting, reduces the reliability of financial ratios as factors influencing insolvency (Arditi *et al.*, 2000).

On the dynamism of the construction industry, the dynamic nature of the industry with constantly changing trends (Chang, 2001; Odusami *et al.*, 2003; Dai and Wells, 2004; Navon, 2005 Navon, 2007; Razak Bin Ibrahim *et al.*, 2010) means the main causes of failure of construction firms will vary from time to time. This implies that subjects will have to be spoken to in order to identify key reasons behind failure construction firms. Although it is not impossible for all the identified reasons to be observable objectively as done CI-BPM studies, the fact remains that this will not always be feasible due to the dynamism of the industry. Ultimately, leaving out the subjects appears no to be a wise choice if a valid CI-BPM is to be built.

The need to involve social factors, which can mainly be considered through subjectivism, and the need to talk to subjects to understand the dynamism of the construction industry, both call strongly for the adoption of the subjective epistemology in CI-BPM studies. Subjectivism emphasizes on *"understanding the meanings that individuals attach to social phenomena"* (Saunders *et al.*, 2009, p.111).

PROPOSED METHODOLOGICAL POSITIONS FOR DEVELOPING A ROBUST CI-BPM

Proposed Paradigm, Ontology and Epistemology

Having reviewed numerous CI-BPM studies, the authors propose that the best paradigm for developing a CI-BPM is pragmatism. *"Pragmatism argues that the most important determinant of the epistemology, ontology and axiology you adopt is the research question – one may be more appropriate than the other for answering particular questions"* (Saunders *et al.*, 2009, p.109). Pragmatists are more concerned with the *"practical consequences"* of the research findings and as such believe that one standpoint can never be suitable for answering all types of research questions and there *"may be multiple realities"* (Saunders and Paul, 2013, p.58). This is the maximalist view noted by Callon (2006) which argues that nothing in a research phenomenon can escape pragmatics. Pragmatists neither agree with positivists in that demands of a research cannot be fully satisfied by a theory (falsify-ability, objectivity, etc.), nor with interpretivists in that demands of a research can be satisfied (at least partly) by almost any theory (Powell, 2001). This is in similarity to the Actor-network theory (ANT) which *"privileges neither natural (realism) nor cultural (social constructivism) accounts of scientific production, asserting instead that science is a process of heterogeneous engineering in which the social, technical, conceptual, and textual are puzzled together (or juxtaposed) and transformed (or translated)"* (Ritzer,

2004, p.1). Pragmatism thus allows the use of any, or a mix of multiple methods, approaches, choices, techniques etc. as long as they will help to answer the research questions properly (Saunders *et al*., 2009). It allows the researcher to *"study what interests you and is of value to you, study in the different ways in which you deem appropriate, and use the results in ways that can bring about positive consequences within your value system"* (Tashakkori and Teddlie, 1998, p.30)

The authors believe the relative rigidity of other paradigms as to the methodological positions that fit a research can limit steps needed to be taken to complete quality research, just as confirmed by Saunders *et al*. (2009, p.109) that *"the practical reality is that a particular research question rarely falls neatly into only one philosophical domain"*. Further, a good CI-BPM study should focus on failure of construction firms (a problem) experienced by construction business owners (people) and the effect of developing a BPM which will allow timely intervention that can prevent potential failure (consequence of inquiry). Such focus is synonymous with pragmatism which *"emphasizes the practical problems experienced by people, the research questions posited, and the consequences of inquiry"* (Giacobbi Jr. *et al*., 2005, p.18).

The realist ontology used for BPM studies is very appropriate and is consequently proposed here. There is only one reality and that is 'construction firms do fail and failing construction firms have certain similar attributes'. Finding the most effective attributes to develop a CI-BPM is what is tricky. This is why there are many BPM studies, each trying to prove certain attributes are more effective than others.

Although the objective epistemological stance is suitable for developing a BPM, a combined subjective and objective approach in a facilitation manner (see later) is proposed here. While the objective approach will aid the use of existing factors and variables, the subjective approach can be used to identify temporal factors and variables that can be used to develop a robust CI-BPM; this would have taken the dynamism of the construction industry into consideration. The subjective approach can also help identify important social and managerial factors that contribute to insolvency of the construction industry. This has long been advocated by many construction management (CM) authors (Seymour *et al*., 1997; Dainty, 2008) who queried the focus on objects, when at the centre of most CM research is people (subjects), justifying need for greater emphasis on qualitative enquiry. Management level staff and/or owners of failed and existing construction firms can use their practical experience to contribute vital information in terms of factors that affect insolvency and survival of construction firms. Since both the objective and subjective epistemology are vital for CI-BPM studies, the integration of quantitative and qualitative research approach is proposed here. This is in line with the much advocated methodological pluralism (Seymour *et al*., 1997; Mingers and Gill, 1997) which combines methodologies from varying paradigms to provide richer insights into relationships and their interconnectivities (between factors and firm failure in this case); this is the best approach to solving research problems (Mingers and Gill, 1997)

In this vein, the proposed methodology agrees with the popular Seymour and Rooke's (1995) work which clearly argued that different researches require different methods and no methods should be ruled out a priori. However, it does not support their opposition to the multi-paradigm (see Rooke *et al*., 1997) approach which pragmatism allows if it is what will bring about a valid methodology. In fact, such an opposition is tantamount to nullifying some methods a priori since selecting a particular paradigm readily nullifies some methods; an act Rooke *et al*. themselves preach against.

Proposed Research Strategy and Approach

The subjective epistemology aspect of the work should be executed with the case study strategy. Case study is defined as a research strategy involving empirical examination of a specific incident using multiple sources of evidence (Robson, 2002). The reason for proposing case study is to allow a comprehensive study of some failed construction firms in order to identify these questions: what are the common factors that lead to insolvency and how do these factors affect insolvency? This reason goes down well with case study's superb capability of obtaining answers to the 'what'? and 'why'? questions (Saunders *et al*., 2009). The case studies can be accomplished using unstructured interviews and maybe focus group discussions. The factors gotten should be analysed to identify befitting measuring variables which can then be measured with a survey research strategy. Survey can be executed with a Likert scale questionnaire, allowing respondents to rate the extent to which each variable applies to them.
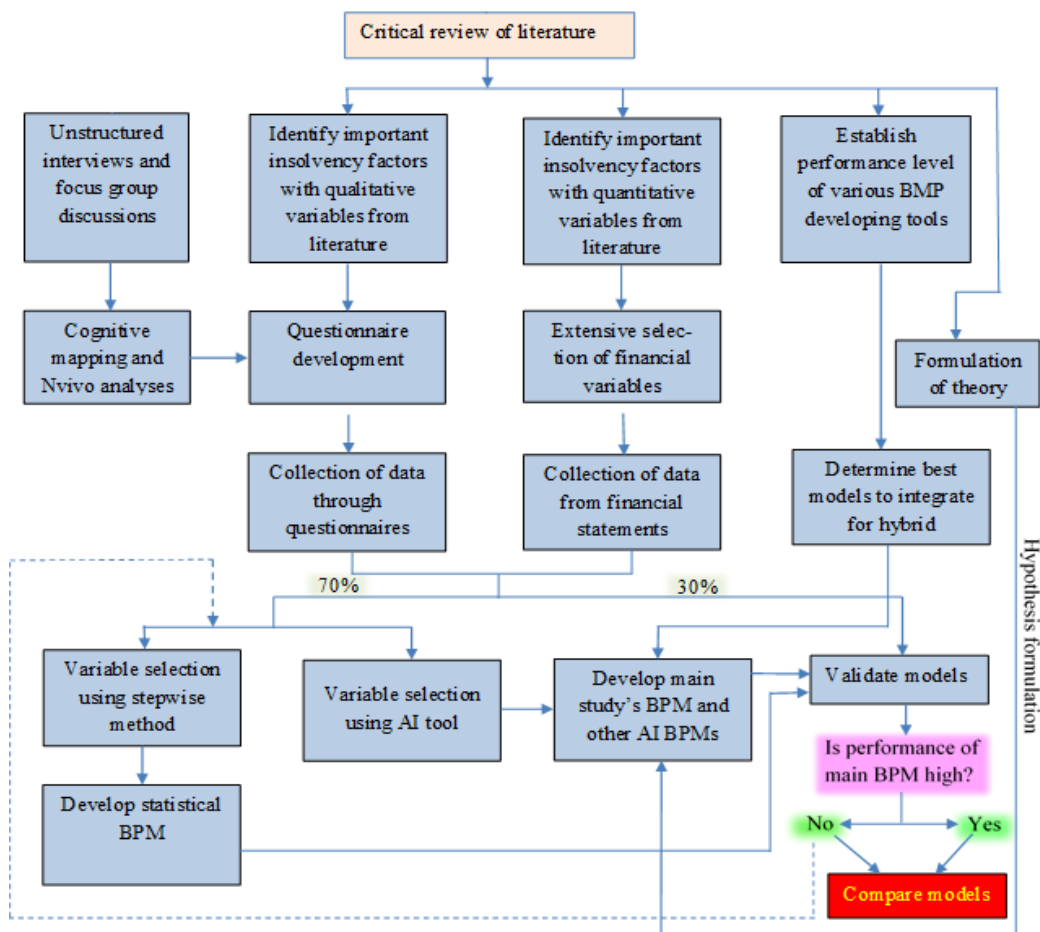

Figure 1: An improved research design for developing CI-BPMs (AI: artificial intelligence)

Archival research strategy, which involves collecting data from companies' administrative documents (Saunders *et al*., 2009), is generally required in most BPM studies as it is used to access the financial information of sample firms. The term 'archival' in this strategy does not directly mean 'old' in anyway as pointed out by Saunders *et al*. (2009) hence using recent financial statements also fall under this category. Financial ratios from these statements are normally directly used as variables for developing CI-BPMs. Archives of financial data can be gotten from financial firms or third parties like Dun and Bradstreet, Company House, etc. Both archival and survey research strategies represent objective epistemology.

This proposed strategy culminates in facilitation which involves the *"use of one data collection method or research strategy to aid research using another data collection method or research strategy within a study"* (Saunders and Paul, 2013, p.154). Here the case study strategy aids the survey strategy. The proposed strategy also shows the intended mixed method approach (qualitative and quantitative data and analysis) which is a very good approach since it ensures an all-round effectiveness of research (Creswell and Clark 2007) and is well in line with the proposed pragmatism philosophical stance (Giacobbi Jr. *et al*., 2005). Figure one shows the research design for the proposed methodology.

The research approach used in virtually all these CI-BPM studies is deduction which is quite common with the positivism paradigm (Easterby-Smith, 1991; Saunders *et al*., 2009).   Basically, most of the studies test and confirm the theory that financial ratios, or some other commonly known variables, can be used to predict potential failure of construction firms; theory testing is a feature of deduction (Saunders *et al*., 2009). This approach is okay for CI-BPM studies since there is abundance of literature in the research area; according to Saunders *et al*. (2009) abundance of literature in an area of study easily lends new studies to the deductive approach. However the theory does not always have to be the same as financial ratios alone are not sufficient for predicting the insolvency of construction firms

CONCLUSION

Positivism is about the only paradigm used in CI-BPM studies. This is not surprising since BPMs are all about large data size, statistical analysis, operationalization, prediction, generalization, etc. The deductive approach used in BPM studies is quite appropriate since there is abundant literature on the subject area and there is always a theory to be tested. The ease of getting financial ratios from third parties, or getting other variables through questionnaires explains why the objective epistemology is the common position taken by CI-BPM researchers. Although most methodological positions taken by CI-BPM researchers look appropriate, the methodology as a whole can be improved if better CI-BPM are to be developed. The key area of improvement would be to first use a subjective approach, through case studies for example, to identify temporal factors affecting failure of construction firms. These factors can then be analysed to establish measuring variables which can be used, along with other known variables, to build a robust CI-BPM

There is no doubt that the readily available nature of financial ratios is a major contributor to the reasons researchers use the objective approach to building CI-BPMs. It is hoped that the implication of this study on practice is that future CI-BPM developers will take the more demanding step of combining the subjective approach to the more popular objective approach. CI-BPM built with such an approach is bound to be of a higher performance, more valid and have wider acceptability.

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