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An abductive approach to qualitative built environment research: A viable system methodological exposé

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An abductive approach to qualitative built environment research

A viable system methodological exposé

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Abstract

Purpose – Qualitative researchers are often confronted with a dilemma of selecting an appropriate approach within which to situate their research. This has led to successive attempts by qualitative researchers in the built environment (BE) to combine two dominant approaches – deductive and inductive; in the conduct of their inquiry. Such attempts can be traced to the poor comprehension of the abductive approach. The purpose of this paper is to elucidate the principles of the abductive approach and illustrate its applicability within the context of BE qualitative research.

Design/methodology/approach – In this study, an illustrative case study is used to depict the usefulness of the abductive approach in BE research. The case relied upon is a recently completed study of an infrastructure delivery system and an assessment of the system's ability to deliver on socio-economic sustainability objectives.

Findings – It was established that extant theories, particularly those with a history of provenance, could be used as a basis for the development of testable propositions for assessing certain phenomena, qualitatively. However, the manner in which these propositions are utilised under an abductive approach is pivotal to the generation of credible findings.

Research limitations/implications – It is expected that the findings of this paper would create awareness among researchers on the relevance of an abductive approach to qualitative research.

Originality/value – This study makes an authentic contribution towards resolving the challenge confronting qualitative researchers within the BE discipline as it pertains to selecting between deductive and inductive approaches. In this case, an abductive approach is suggested and its modalities shown through a comprehensive study.

Keywords Case study, Qualitative research, Built environment, Infrastructure delivery, Abductive approach, Viable systems model

Paper type Research paper

Introduction

Researchers are confronted with the dilemma of choosing the appropriate approach to apply in their attempt to establish a link between theory and research (Ali and Birley, 1999). This has resulted from the perceived inadequacies of two most widely used approaches, the inductive and deductive approaches. Bryman (2012) posits that the task of establishing a definite connection between theory and research remains an onerous one for qualitative researchers. This critical position arises due to the fact that theory forms the bedrock of any social enquiry and provides a rationale for the research being performed. Also, it provides a framework upon which social phenomena can be understudied and findings interpreted (Bryman, 2012). Saunders *et al.* (2012) assert that theory may not seem crucial at the inception of a research activity. However, they maintain that its relevance during the presentation of the research findings and conclusion stages, respectively, makes it imperative that the researcher decides at the inception of his investigation on whether he

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wants to test existing theory or develop a new one. Furthermore, Easterby-Smith *et al.* (2008) adduce reasons why the choice of research approaches remains essential. They state that the structure of a research design is dependent upon the research approach adopted. Blaikie (2009) advises that the choice of a particular research approach at the initial stage of a research activity should be based on the need to provide answers to the study's research questions, effectively.

Increasingly, researchers are being confronted with the dilemma of mixing different research strategies as it concerns theory testing or building within the context of a particular study. This has led to the inherent polarisation of researchers along deductive and inductive lines as well as a mixture of both approaches. This imbroglio seems to have been resolved by the abductive approach (Blaikie, 2009; Bryman, 2012; Dubois and Gadde, 2002; Saunders *et al.*, 2012). They agree that this approach enables the researcher's engagement in a back and forth movement between theory and data in a bid to develop new or modify existing theory.

Yet, there appears to be a slow uptake of the abductive approach within the community of qualitative researchers in the built environment discipline. Adducing reasons for this perceived apathy happens to be beyond the scope of this particular study, but the authors will attempt to share their experience on the applicability of the approach in a recently completed study. It is expected that such insight will contribute towards bringing about, more awareness to the abductive approach. Furthermore, this study seeks to stimulate a debate into the suitability of this approach in the conduct of qualitative research in the built environment.

To attain these objectives, a concise discourse on abductive approach is conducted. This is followed by a background to the main study which this reportage forms an integral part. Subsequent parts of the study reflect on the application of the abductive approach in understudying the phenomenon mentioned. Besides rendering a step-by-step account of the considerations which led to the selection of the abductive approach, the inherent reflections provide a narrative on how the research process was guided by the approach, especially as it pertains to the use of an extant theory, the viable systems model (VSM).

Understanding the abductive approach

According to Reichertz (2004), the evolution of the abductive approach can be traced to attempts at translating the Aristotelian apagoge. He attributes the contemporary knowledge of abduction to the attempts of C.S. Peirce (1839-1914) in this regard. According to Novak (2001), Pierce's seeming discontent with the theory of balancing likelihoods (TBL) approach which was being utilised by nineteenth century historians in translating Aristotle's apagoge, motivated him to propose a scientific approach towards achieving the same purpose. Such discontent stems from issues mentioned by Novak (2001), which are portrayed in subsequent paragraphs.

Significant among the concerns raised by Pierce is the apparent unsuitable scenario where an author, seeking to relate to and report historical events, relies on the testimonies rendered by another author. He argues that it would be illegitimate to present all of such testimonies as if they were of equal standing and independent value, a move encouraged by TBL.

Second, the absence of a methodology for exploring the credibility of an author when he narrates a particular event is a problem as the author is often "considered as standing in a unique relation to each state of affairs that is narrated, and therefore statistics are of no help in ascertaining where what is being reported in a particular case is true or false" (Novak, 2001, p. 4).

Finally, the adoption of a demonstrative kind of reasoning in the study and narration of history. To counter these shortcomings, Pierce proceeds to proffer a scientific approach (a mix of the abductive, deductive and inductive approaches), which carefully frames a hypothesis, outlining the consequences of such hypothesis and subsequently testing those

consequences through a comparison with facts that were not taken into consideration during the formation of the hypothesis.

Novak (2001) highlights Pierce's attempt to distinguish between abduction and induction whereby he describes the former as proceeding from facts to an explanatory hypothesis whereas the latter proceeds from a hypothesis towards supportive facts. Having utilised this scientific methodology in translating Aristotelian Corpus, Pierce is recognised as making significant contributions to the advancement of the abductive approach.

Patokorpi and Ahvenainen (2009) maintain that Peirce sought to highlight the fact that there existed after all, a logic for scientific discovery. However, this fact has been heavily disputed by inductivists and deductivists alike (Patokorpi and Ahvenainen, 2009). The abductive approach has been trailed by criticisms (Kapitan, 1992; Reichertz, 2010). Kapitan (1992) mentioned various inconsistencies which surrounded Peirce's works especially as it concerns the difference between his earlier works and his later ones. Furthermore, he insists that these inconsistencies were capable of engendering apprehension over the use of abduction. Similarly, Reichertz (2010) states that the abductive approach was originally thought of as nothing more than an act of inferring from guesses and most researchers did not want to be seen as engaging in such. Paavola (2004) also admits to the existence of several criticisms against abduction as the logic of discovery.

Probing further into the process of abduction, Svennevig (2001) cites Pierce (1955, p. 151) as reiterating that "the surprising fact, C, is observed; But if A were true, C would be a matter of course. Hence there is reason to suspect that A is true". This description of the abductive process happens to be analogous to the views espoused by Aliseda (2007) who describes abduction as the reasoning that proceeds from an observation to its possible explanations or better put its most plausible explanations. As a result of this, the question concerning what constitutes the best explanation in an abductive approach sticks out like a sore thumb (Lipscomb, 2012). Lipscomb further avers that for findings from abductive approach to be considered as valid and credible, it must be supported by deductive and inductively sourced evidence. Similarly, Plutynski (2011) observes that the plethora of criticisms surrounding the abductive approach as propounded by Peirce have largely been centred the formalization indeterminacy problem, the boundary problem, the justification problem and the descriptive problem, respectively.

Going into these challenges are beyond the scope of this study as the study seeks to reflect on how the authors were able to successfully apply the abductive approach in a contemporary research study.

Reflections on the abductive approach's utility in the main study

The main study is premised on the quest to provide a theory for describing the implementation of socio-economic objectives (socio-economic sustainability) during the procurement and delivery of oil and gas infrastructure in Nigeria. Globally, advocacy for the utilisation of public procurement to drive the attainment of socio-economic objectives for the local economy has assumed centre stage (Binks, 2006; Macfarlane and Cook, 2002; McCrudden, 2004; Snieska and Simkunaite, 2009; Thai, 2001; Watermeyer, 2003; Wells and Hawkins, 2008). This realisation of the impact infrastructure investments had on a country's economy attracted the authors' lenses to the Nigerian situation.

But there appears to be a consensus on the inability of significant infrastructure investments in the Nigerian oil and gas industry to bring about the desired socio-economic objectives for the country's populace. Various studies have carried out investigations into the existence or otherwise of linkages between the nation's oil and gas industry and other sectors of the economy such as construction and construction output (Saka and Lowe, 2010a, b); small- and medium-scale enterprises (Ihua, 2010); backward linkages with the Nigerian economy (Adewuyi and Oyejide, 2012); development of local technological know-how

by indigenous oilfield servicing firms through innovative capabilities (Ozighbo, 2008); the regulatory impact brought to bear on the industry through content development by the Nigerian Oil and Gas Industry Content Development (NOGICD) Act of 2010 (Atsegbua, 2012); and the issue of struggling local suppliers (Vaaland *et al.*, 2012).

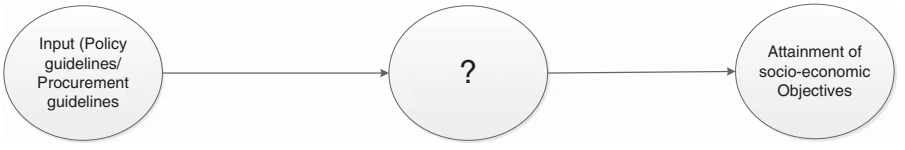
However, they appear to have neglected the project delivery systems utilised in the projects understudied. This neglect was perhaps predicated on the absence of a succinct theoretical background for enabling a better understanding of the processes and relationships between actors in the delivery system in a systemic manner. Rather, they progressed in a manner that depicted reductionism. According to Larson and Gobeli (1989) and Awuzie and McDermott (2015), the manner in which a procurement system is organised was capable of either delivering the client's main objective or vice versa. Neglecting the mode of project organising adopted in the delivery of these objectives would be akin to proceeding on a faulty premise.

This was the aspect which the authors sought to make a contribution towards. It was expected that the creation of a theoretical background, upon which the hitherto black-box (see Figure 1) of the project delivery system could be explained, will encourage subsequent researchers to better understand the system and proffer appropriate solutions.

Often times, the process subsystem of the project implementation system is treated as a black-box (see Figure 1). Accordingly, the quality of relationships and processes which are inherent in that subsystem is judged on the basis of the eventual outcome/output of the system. This has been the practice and most of the scholars mentioned previously have relied on the outcomes of the system in assessing the process subsystem. This negates the principle of systems thinking practice as every subsystem should benefit from an assessment, during the evaluation of an entire system. This led to the decision of the authors to seek a theoretical background to unravel and better explain the inherent relationships experienced within this so-called black-box. Successful implementation of the socio-economic objectives of the Nigerian government which are encapsulated in the NOGCID Act was mainly dependent on the manner the relationships within the delivery system were organised and governed. Viewed from an abductive approach perspective, it would be succinct to state that this line of thinking evolves from an observation that:

> The failure of the infrastructure delivery systems to deliver on socio-economic objectives within the Nigerian oil and gas industry context is observed; But if there was no disconnect between the strategic level and the implementation level (the project delivery environment) within such infrastructure delivery systems, then their ability to deliver on such objectives would be a matter of course. Hence: there is reason to suspect that such disconnect exists within these infrastructure delivery systems.

Deriving from this observation which according to Aliseda (2007) can be described at best, as hypothetical, the need for an appropriate theoretical background to explain the relationship between the stakeholders and how such relationship influences socio-economic policy implementation within the infrastructure delivery system (IDS). This gives rise to the need for a relevant theory for explaining the observation adequately.



Source: Authors' sketch (2017)

Figure 1.
A simple input-process-output system diagram of the project delivery process

Pierce's version of the abductive process does not necessarily stand-alone but rather seeks to take other approaches into cognisance. Svennevig (2001) maintains that Pierce advocated for the adoption of the three modes of inference with three different stages, namely:

- first stage: abduction (adopt a hypothesis/proposition on probation);
- second stage: deduction (spell out the necessary and probable experimental consequences); and
- third stage: induction (assess the plausibility of the hypothesis on the basis of observed results of predictions).

This aligns with the opinion of Lipscomb (2012) wherein he observes that abductively led qualitative research in the nursing discipline must be supported by evidences sought for and obtained through deductively and inductively oriented pathways. Continuing, he maintains that such evidence should differ significantly from that which was generated by the initial proposition.

Therefore, it is trite to maintain that the statement made about the failure of IDSs to deliver on socio-economic objectives can be viewed from the perspective of these three stages:

(1) a viable IDS will deliver on client objectives such as socio-economic objectives;

(2) due to the extant disconnect between the strategic and implementation levels of the IDS, it has failed in delivering on socio-economic objectives within the Nigerian economy; and

(3) explaining such disconnect as well as identifying the reasons behind it can only be achieved through the use of an appropriate theoretical context to appraise the IDS.

Quest for a relevant theory

According to the Peircean abductive approach, the use of theories with immense degrees of provenance for explaining the propositions is surrounding a particular phenomenon (Lipscomb, 2012). Continuing, Lipscomb avers that the mere fact that theory x not only exists but also appears to support the interpretation y (the proposition) does not guarantee a sufficient interpretation. Rather, it has to be established that theory x does in fact support y. To do this effectively, adequate justification has to be rendered for the choice of background theory made during the course of an abductive study.

In this case, the authors decided to premise their search on relevant systems thinking theories. This was informed by the systemic nature of the IDS. During the search, they came across the theory of systems viability which was deemed appropriate for the inquiry and possible explanation of the proposition.

The theory of system viability

The theory of systems viability is premised on an aggregation of thermodynamics, information theory, systems theory and cybernetics (Schwaninger, 2006). Often depicted through the VSM and the living systems theory (LST), it consists of essential components of a social system which bring about viability or survival of the system. The term "viability" is used to connote that particular characteristic of a given system to survive in a given environment, notwithstanding the degree of adversity which the environment exerts on it (Espejo, 2007). These systems not only possess the ability to survive, but also to retain within themselves the capability to respond to any uncertainty resulting from its host environment, capable of undermining its performance.

Social systems cope with complexity by means of adaptation and learning processes in which communication and control have a significant role to play. This theory derives its roots from the support of the system-oriented management theory and cybernetics. Ashby (1956, p. 1) cites Weiner as having described cybernetics as "the science of control and communication, in animal and machine". Furthermore, he posits that co-ordination, regulation and control are the cardinal features of this discipline. This description provides the impetus for the authors to adopt this theoretical lens to explain the failure in communication, control and regulation between the strategy and project-level implementation subsystems of an IDS. According to Beer (1979), viability remains a common goal, either long term or, in the case of temporary organisations, at least long enough to accomplish its intended purposes. The theory of systems viability emanates from this concept of viability. Systems viability in the context of this study connotes the ability of a given system to maintain separate existence within a given environment, notwithstanding the degree of adversity or comfort which the environment exerts on such a system (Espejo, 2007).

As mentioned earlier, the theory of systems viability is often depicted by two models, namely, the VSM and the LST. The authors had to choose one of these models in explaining the proposition. This task is made easier by the fact that the models operate on different perspectives and contrasting philosophies, respectively (Schwaninger, 2006). Table I highlights these differences and similarities.

Schwaninger (2006) summed up this comparison of the LST and the VSM by observing that whereas the LST has an advantage over the VSM in the area of possessing an empirical underpinning, the VSM towers above the LST in two distinct aspects: the strength of theoretical claim/falsifiability; and diagnostic potency. According to Pfiffner (2010), the VSM nullifies the classical separation between organisational structure and organisational processes, as it is in the classical organisational models by combining these two facets. It provides the determinants required for distinguishing between good and bad as well as right or wrong, between organisational processes which are otherwise lacking within the classical hierarchical models. He stressed that the VSM was a useful tool, as it integrates all the necessary and sufficient elements for the functioning of the organisation and their interaction in a relatively simple model that repeats itself on every level of recursion.

The VSM acts as a sensitising framework, alerting the analyst to alternative ways of understanding. It appears as a sophisticated organisational model which must be observed if an enterprise is to succeed as an adaptive goal-seeking entity. It is geared to tackling problems of differentiation and integration; providing insight into the proper

Areas of differences (similarities)	VSM	LST
Philosophical perspectives	Constructivist approach	Positivist approach
Complexity	Subjectivist approach to complexity	Objectivist approach to complexity
System's concept	Non-open	Open
Unit of analysis	Capability and potentiality	Actuality
System's purpose	The identity of the system	Associated with openness and integration of subsystems
Model's components	Five critical management functions	Twenty critical subsystems
(Basis of the model)	Graphically formulated and verbally descriptive (non-mathematical)	Graphically formulated and verbally descriptive (non-mathematical)
Principles of organisation	Autonomy, recursion and viability	Operational processes

Source: Schwaninger (2006)

Table I.
Difference/similarities between VSM and LST

arrangement of command and control systems and into the design of appropriate management information and decision support systems; and treating sensitively organisation-environment relations (Davies, 2007).

These views affirm the case for the use of the VSM, as an appropriate theory for explaining the proposition rendered previously. Figure 2 highlights the application of the VSM in explaining the proposition as observed within the hitherto black-box (the project delivery/policy implementation subsystem). The facets upon which such an explanation would be premised are provided therein and consist of: communication, control, co-ordination, regulation among subsystems within the IDS.

Furthermore, the definition of project delivery systems (IDSs) by Lahdenpera and Koppinen (2009) as "[…] the organizational framework of a project that defines the control mechanisms and the relationships between actors and incentives […]" lends credence to the need for the application of a systems thinking and the cybernetic-oriented theory in explaining its mode of organisation. It highlights the imperative nature of control mechanisms between the actors in the delivery of client/project objectives.

VSM. The VSM has its origins in the work of Stafford Beers in applied operational research and cybernetics in the British steel industry in the 1950s. It is a neurocybernetic model. That is, it draws upon research on the human nervous system, especially on the brain and its regulatory attributes. Regulation depends on matching complexity in the control with the complexity generated within the system. The VSM is used to diagnose and/or design organisations for viability (Hoverstadt, 2011). It distinguishes among five management functions and among a number of vertical and horizontal communications channels. The VSM is most useful when a shared agreement exists about what the purpose of a system is; and the boundaries of the system (Hoverstadt and Bowling, 2002). This model is premised upon the theory that every viable organisation must possess five subsystems for it to attain viability. These five different subsystems usually labelled systems 1-5 play a dominant role in maintaining the viability of social organisations. The VSM has been applied successfully in qualitative research studies (Hildbrand and Bodhanya, 2011).

Figure 3 presents the VSM whilst its component parts are described in Table II.

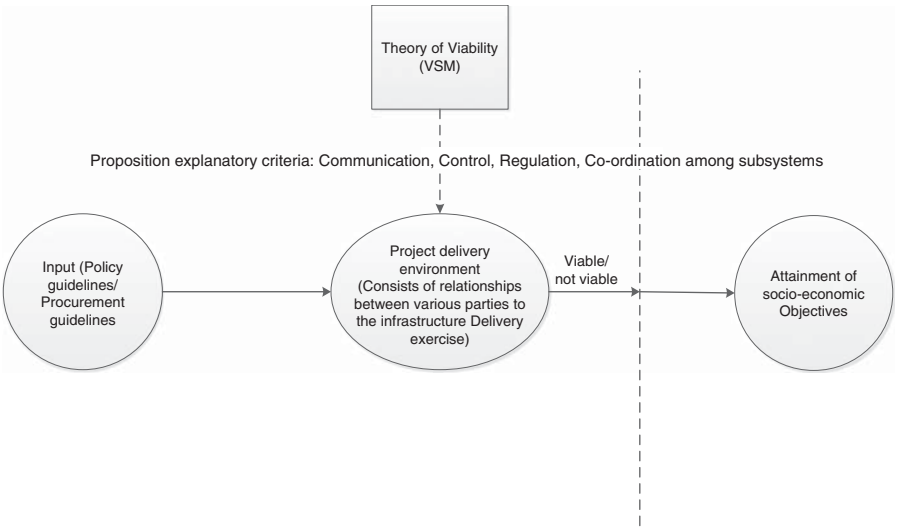
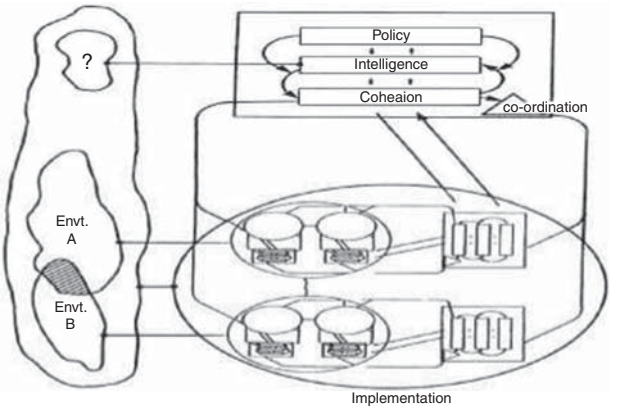


Figure 2.
An illustration of the application of the theory of systems viability (VSM) on the simple systems thinking model

Source: Authors' fieldwork (2017)



Source: Espejo and Reyes (2011)

Figure 3.
The viable systems model (VSM)

Subsystem (number)	Function
Policy (5)	This is responsible for the policy making duties of the organisation. Its major functions include the provision of overall clarity and purpose for the organisational unit and to prepare a concrete and tenable design for organisational efficiency
Intelligence (4)	This functions as a connection between the VSM and the external environment. It is responsible for the projection of the organisation's image and message to the external environment as well as obtaining information from the external environment to the VSM. It is future focussed but maintains a communication loop with the control subsystem to complement the control function
Control and monitoring* (3 and 3*)	This subsystem serves as a channel through which resources are negotiated and the issuance of direct line management takes place. The monitoring function is also domiciled within this subsystem, serving as a corroboration agent to the control function so as to ensure accountability
Co-ordination (2)	These are the systems put in place within a VSM to co-ordinate the interactions between the support functions and between the autonomous units
Implementation (1)	This system is responsible directly for the production or provision of services to the customer/clients

Sources: Brocklesby and Cummings (1996); Polese *et al.* (2009)

Table II.
Components of a VSM

Going by the functions presented in Table II, the applicability of the VSM in exploring and explaining the proposition on systemic disconnect within the IDS and the influence such disconnect wields on the delivery system's ability to deliver on policies relating to socio-economic objectives is deciphered.

A case study research design

Case studies remain the preferred strategy for studies such as this given its ability to allow investigators study a phenomenon in its natural context. Yin (1994, p. 59) defines a case study as an "[…] empirical inquiry that investigates a contemporary phenomenon within its real-life context and addresses a situation in which the boundaries between phenomenon and context are not clearly evident".

The case study approach relies upon multiple sources of evidence thus allowing the researcher to apply multiple methods in the conduct of his investigation as is the case in

this particular research. Flyvberg (2006) supports the adoption of case study research design for reasons such as the ability of the case study approach to lead to the development of context-dependent knowledge; and the fact that in the study of human phenomenon, the context-dependent knowledge appears to be the only viable approach, hence rendering epistemic theoretical development ineffective. Blaikie (2009) opines that the main criticisms of the case study strategy result from the generalising and theorising perspectives. The use of multiple cases has been criticised as an attempt by qualitative researchers to attempt statistical generalisation against analytical generalisation (Easton, 1995). This criticism has been countered by arguments from Yin (2009) and Dubois and Gadde (2002). The adoption of multiple-case study method encourages and sustains enhanced replication across cases (Amaratunga and Baldry, 2001; Eisenhardt, 1989; Eisenhardt and Graebner, 2007). Yin (1994) corroborates this view stating that multiple-case studies were more capable of providing a stronger foundation for theory building than the single case study. The usage of multiple sources of evidence as the way to ensure construct validity has also been advocated (Yin, 2009).

Using multiple cases to test a range of cross-case propositions assists in boosting the external validity and enhances replicability, both literal and theoretical alike. The unit of analysis provides the internal validity as the theories are developed. The unit of analysis for this study is the IDS as portrayed through a VSM lens. The use of the VSM helps to resolve one of the perceived deficiencies of case studies when used within the context of the abductive approach as identified by Dubois and Gadde (2002). In their work on systematic combining, they observe that case studies are faced with the daunting challenge of handling the interrelatedness of the several elements and factors evident in the research activity. The multi-layer nature of the VSM allows for the researchers to use it to identify these interrelationships within IDS-based case studies with ease. These enumerated applications support the adoption of an exploratory case study strategy for the study as the IDS is a complex scenario which needs to be evaluated from a real life context with the VSM as an appropriate methodology. Semi-structured interviews, observation and documents were adopted as data collection techniques. It is beyond the scope of this paper to justify the reasons for adopting these techniques save for the fact that they have been known to provide appropriate platforms for the unrestricted expression of personal and organisational perspectives and do come highly recommended (Denscombe, 2007; Hartley, 2004; Kvale, 2006).

The selection of cases was premised on the following criteria, namely: possession of the features required of an IDS as proffered in the literature within the case; the IDS must consist of the holistic processes inherent in infrastructure delivery, from the decision making (policy making) to commissioning of that infrastructure project; the cases must be part of the public sector's socio-economic advancement initiatives such as the local content development through the enhancement of the degree of international competitiveness of the domestic supply chain; and the contemporary nature of the case should also be taken into consideration during the selection process as the projects to be selected are to have reached financial close. Three case studies were utilised in this study.

The utility of models as constructs in abductively led qualitative research

Eisenhardt (1989) advocates for the use of constructs in qualitative case study based research. She states that researchers stand to benefit from an initially defined construct to enable enhanced understanding and to provide a platform for the initial design of theory development. Ali and Birley (1999) identify the merits of using models as constructs as including: assisting qualitative researchers to deal with general themes rather than concentrating on specifics, thus allowing for a diversity of opinions and generating new variables which were not anticipated originally; and the salient fact that the use of models

and/or constructs provide a focus for the investigation whilst leaving open avenues for the generation of new inadvertent findings.

Accordingly, VSM enabled the identification of various actors and activities which they undertake in the process of achieving socio-economic benefits during the infrastructure delivery processes in the oil and gas industry. Furthermore, it avails them an opportunity to ascertain the interorganisational interdependencies prevalent within the IDS (IDS) and the contributions of these organisational representatives towards the delivery of socio-economic benefits.

The VSM engendered the establishment of a link between all the parties, hence allowing for improved access and a proper discernment of the attendant high levels of complexity associated with such delivery systems. The accounts rendered by the actors of their activities and the interdependencies existing between these actors as well as their views as it concerns the phenomenon under investigation is used to construct a theoretical model (Blaikie, 2009) and then compared against the actual VSM thus providing for an in-depth explanation of the proposition based on the new theoretical model. This highlights the VSM's function as an interpretative/explanatory framework (tool) (Figure 4).

Steps 1-5 in Figure 5 outline the application of the VSM methodology towards proffering succinct explanation of the organisation of the infrastructure delivery system *vis-à-vis* socio-economic policy implementation.

A clearer insight into these steps is rendered below.

Step 1 – identification of stakeholders

First, the VSM allows for an identification of all the stakeholders within the selected IDS. After this, the researchers embark upon establishing the roles played by these stakeholders in the delivery of infrastructure within the IDS. Given the complex nature of systems such as

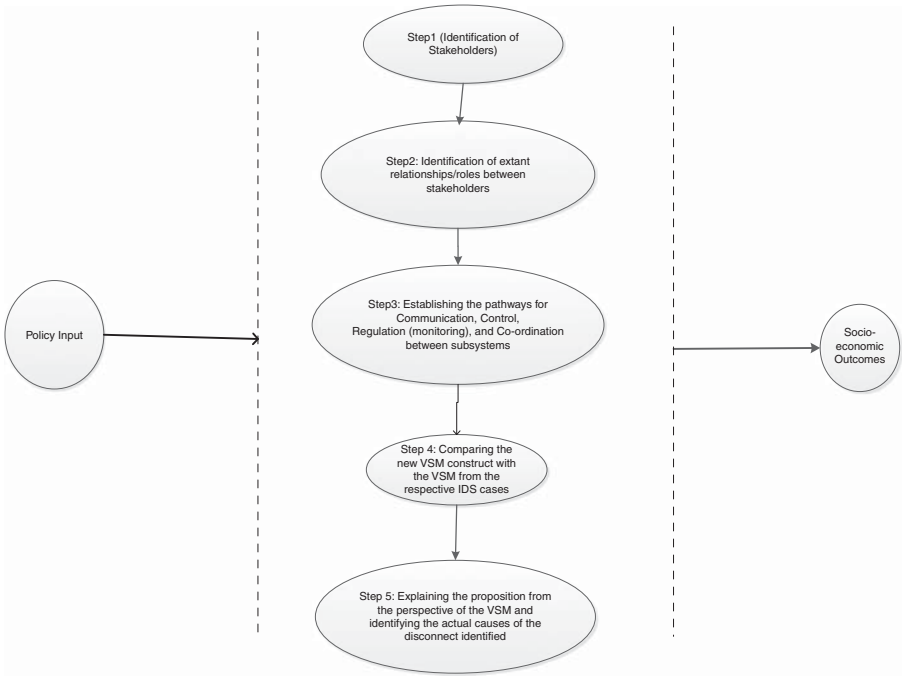


Figure 4.
Application of the VSM's tenets in explaining the implementation "black-box"

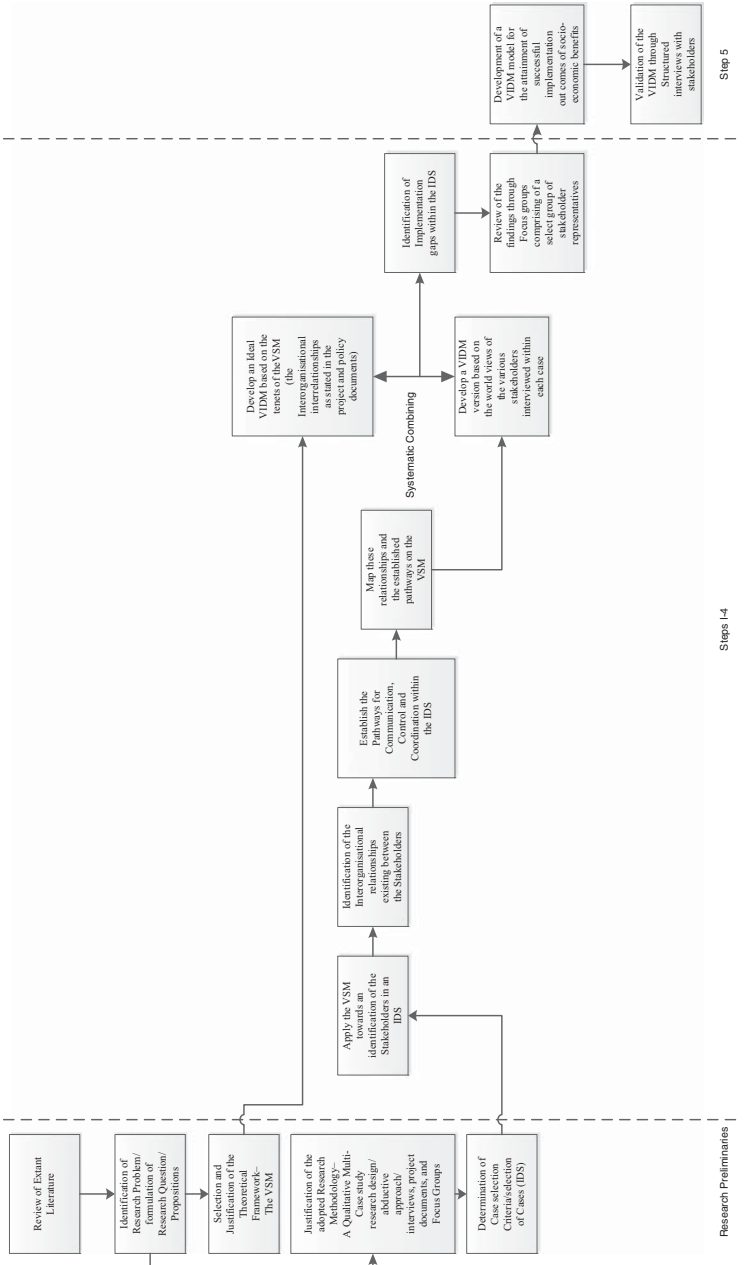


Figure 5.
The research protocol

the IDS (Van Marrewijk *et al.*, 2008), most researchers find the task of identifying stakeholders, their roles, the degree of interdependence of these roles and its eventual impact on sustaining the viability of the IDS in related studies, a herculean one. As such, they end up focussing on a particular group of stakeholders or at best attend to their research by isolating certain stakeholders whilst dealing with others at a particular time. The VSM provided the researchers the opportunity to provide a properly linked structure of interorganisational relationships existing between the respective stakeholders. The stratified and interlinked nature of the VSM made the identification possible. The investigators were able to concurrently look at all the participants as members of the delivery process without isolating anyone to deal with another. The stakeholders were majorly identified through a review of project-centric and policy documents relating to the project procurement and delivery as well as the NOGICD Act 2010. The VSM's five component subsystems are categorised along the following lines to suit the purposes of this particular investigation/inquest:

- System 5 – Policy: this subsystem is concerned with the strategic level of the delivery system and in the cases being understudied; this level was mostly synonymous with country or regional level policy and policymakers.
- System 4 – Development: this subsystem is used in the context of the IDS to refer to the stakeholders responsible for the development of the policy action plan and subsequent implementation at the various levels – nationally and/or regionally.
- System 3 – Delivery: this subsystem of the VSM deals with the actual delivery of the project, central to the procurement policy.
- System 3* – Audit: in this subsystem, stakeholders responsible for auditing the progress of the project to meet the client's success criteria were identified and classified accordingly.
- System 2 – Co-ordination: this subsystem assumes a similar place like the 3*. It carries out the role of coordinating the roles of the supply chain of the delivery system on behalf of the delivery system.
- System 1 – Operation: this is the subsystem where the actual delivery of the project occurs.

This structure intensified the rate at which the researchers went about the identification of the actors and their expected roles within the IDS. The interlinked nature of the VSM allows for the establishment of the expected communication routes as well as the control, monitoring and co-ordination pathways therein.

Step 2 – Identification of extant relationships/role among stakeholders

Sequel to the identification of the stakeholders and their roles, the researchers inquired into their perceptions about the objective of the IDS, on issues relating to their work environment, their relationship with other stakeholders. Furthermore, the researchers sought to understand how information is processed within the IDS by the various stakeholders. This was done through semi-structured interviews with selected representatives of the various organisations. This was done to ascertain the effective communication channels within the system.

Step 3 – establishing the pathways for communication, control, monitoring (regulation) and co-ordination within the IDS

Based on an understanding of the activities of the actors, a clearer picture of what the IDS being understudied, resembles emerged. With this emergent picture, the researchers sought

to model the accounts generated through the various data sources into a VSM form, replete with its attendant linkages and interdependencies in line with the principles of abduction. Whilst this modelling activity proceeded, the researchers sought to identify relevant themes likely to result in the disconnect observed, particularly proper communication within subsystems the IDS, co-ordination, control and monitoring roles among the subsystems.

Step 4 – comparing the new VSM construct to the VSM developed from the respective IDS case studies

This was done to seek out possible peculiarities and patterns which could give rise to the discovery of new theory or knowledge. It was expected that various patterns would arise according to the different contexts within which these IDSs were situated. This fact is in consonance with theoretical replication (Blaikie, 2007, 2009) where he advocates for the use of replication logic as against sampling logic in multi-case study qualitative research. The findings from each of the IDSs were used to construct individual VSMs representing the actual occurrences within each IDS as it pertained to implementation of socio-economic benefits. Subsequently, these VSMs were compared to an ideal world VSM. Besides enabling an explanation for the initial proposition, it allowed for the establishment of differences between what the IDS was doing and what it was expected to do (purpose). This is in line with the diagnostic capabilities of the VSM. After this, a focus group was assembled to discuss the findings from the data collected previously. The focus group comprised of one representative of the various categories of stakeholders across the selected cases. The focus group lasted for two-and-a- half hours.

Step 5 – Discussion of the gaps identified, development of a model of best practice and validation of this emergent model viable infrastructure delivery model (VIDM)

Finally, the findings from the various data collection and analysis techniques applied were utilised in the development of a VIDM thus leading to the development of theory. The VIDM was validated through structured interviews by a select sample of stakeholders. This is in consonance with the three stages of the process as espoused earlier. The validation of the explanatory model can be described as having been done deductively. Stakeholders confirmed its representativeness and usability as a theoretical model for explaining the unviability of infrastructure delivery systems. Furthermore, they attested to its proficiency for monitoring and coordinating effective policy implementation within the IDS. This fulfils the tenets of the abductive approach in all its ramifications and should be employed by any researcher intent on discovering new knowledge through a logical and scientific manner.

Concluding remarks

Based on the foregoing, the utility of the abductive approach to the qualitative researcher in the built environment discipline is discerned. The utility of the approach as realized from this study can be streamlined to the following aspects; the centrality of a researcher's observation pertaining to a certain phenomenon; the development of hypothesis (proposition) based on this observation; the reliance on a credible background theory in an attempt to explain the proposition; the use of deductively and inductively sourced data in validating the explanation of the proposition; the creation of new knowledge based on the validation of the explanation of the initial proposition. Often times, prospective researchers find it difficult to present a testable proposition concerning a particular phenomenon which they have observed within their context. This study successfully highlights how the abductive research can assist in ameliorating this imbroglio.

Furthermore, the attempt at using of a coterie of background theoretical lenses to achieve the best explanation possible for the proposition prior to its testing is indeed significant and leads to the development of new knowledge. This has been shown in this study as the VSM has been sufficiently applied towards explaining the initial proposition relating to the seeming disconnect between subsystems of an infrastructure delivery system and the influence of such on optimal delivery of socio-economic benefits as enshrined in relevant policies.

The abductive approach lack of interest in the certainty of conclusions has been shown in this study. Rather it seeks to engender informational productivity within specific contexts, which is described as the ability of the study to yield new ideas. In this study, the VSM has been relied upon to lead to new ideas concerning how to explain, diagnose and remediate a delivery systems (in)ability to deliver on expected outcomes. This distinguishes an abductively led qualitative research from a deductively driven or inductively driven study, given that deductive approach does not yield new knowledge as it is fixated on the certainty of its conclusions and not productivity whereas the latter provides greater certainty than abductive approach but less productivity. Also, the integration of the three approaches to support the inferences made from the abductive approach has brought about more credibility of the findings.

Summarily, this study provides step-by-step account of how the VSM was applied in enhancing the process of abductive approach within a multi-context, multi-case study background. It is expected that this study will encourage researchers who are faced with dilemma of engaging in a research activity which requires that they possess a mid-point position between the well-known approach approaches of deduction and induction to try abduction as it has been proven to be a sound process of theory development or as it is usually referred to "a logic of discovery".

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