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AN INTEPRETIVE STRUCTURAL MODELLING ANALYSIS OF SOCIAL VALUE IMPLEMENTATION BARRIERS IN INFRASTRUCTURE DELIVERY SYSTEMS

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Abstract

The debate concerning the contributions of infrastructure assets to economic growth persists in contemporary society. Also, the delivery of infrastructure assets has been identified as veritable platforms for implementing socio-economic policies. Social value (SV) happens to one of such policy which has attracted the attention of the construction industry. However, till date, research into SV implementation performance remains underreported in extant literature. This study set out to bridge this gap through an investigation into the criticality of SV implementation barriers within an IDS by interrogating the nature of interrelationships existing among these barriers. This qualitative study utilized a focus group discussion group session for eliciting the perspectives of a purposively selected sample of key industry actors with extensive experience. Eight discussants participated in the focus group discussion group sessions. The data emanating from the session was subjected to further analysis using the Interpretive Structural Modelling (ISM) to ascertain the relationships between the SV implementation barriers and subsequently, determine the levels of criticality thereof. Findings from the study indicate that poor policy interpretation, poor government support and unnecessary complexity of the implementation process proved to be most critical when compared to other barriers. This study holds significant implications for policy makers and industry practitioners as it provides them with valuable knowledge to enable the development of protocols for engendering successful SV implementation in the IDS.

Keywords: Barriers, Infrastructure, Interpretative Structural modelling, Social Value

INTRODUCTION

Notwithstanding the importance of infrastructure and infrastructure investments in bringing about economic growth [1, 2, 3], an escalating degree of infrastructure deficit persists. Scholars have proposed that this deficit will require an estimated $92 billion per annum over an undisclosed number of years to bridge this gap [4]. Furthermore, the World Bank opines that an estimated $1 trillion infrastructure investment over the next ten years will be needed to bridge this gap [4]. Studies have shown that countries are experiencing a tremendous infrastructure gap which negates their quest to achieve national competitiveness, or better still, provide an improved quality of living for its citizenry [5, 6, 7]. The Covid-19 pandemic has further exacerbated the economic woes being witnessed by countries in this region [8].

There is need for infrastructure delivery systems (IDS) to contribute towards enabling added value to their host environments [9]. This proposition stems from the observation made by Awuzie and McDermott [10] wherein they posit that the way an infrastructure planning and delivery system is organized impacts on the degree of benefits accruing to the host community and/or local economy. Also, the positioning of sustainable development at the epicentre of global developmental discourse has accentuated the need for consideration to be given during the delivery of infrastructure to facilitate the implementation of the social value agenda [11, 12, 13, 14]. In furtherance to this, a noticeable increase in the advocacy for public and private sector infrastructure clients, to leverage their pivotal position during strategic procurement of infrastructure to champion social value (SV) implementation has been observed [11]. These advocacies are premised on the presumption that SV tenets can sustain social cohesion and inclusion as well as economic growth within the 'local' economy. However, these advocacies do not exempt infrastructure clients from delivering assets with precise effectiveness and efficiency as well as the project management success parameters. In apparent realization of the significant budgetary outlays allocated to infrastructure delivery, successive

governments have encouraged steps towards ensuring that this expenditure is used to create and add value to the environment where such assets are being delivered [13]. SV remains one of such opportunities for value-add which has been brought to the front burner recently.

To underscore the importance of SV in the infrastructure sub-sector of any economy, several countries have legislated different approaches for ensuring that a significant proportion of the expenditure is retained in the local economy and devoted to creating added value therein [15]. The Nigerian context is no exception as the government has sought to leverage on significant infrastructure investments in the upstream sub-sector of the oil industry to facilitate this agenda. The introduction of the Nigerian Oil and Gas Industry Content Development [NOGICD] Act is one of such steps [16]. Studies reiterate that recent investments in oil and gas infrastructure by the government and its joint venture [JV] partners have not significantly impacted upon the development of the local supply chains [17]. The lack of skills within the public sector to widespread corruption and poor project governance regimes have been identified as militating against the attainment of these objectives [17, 18, 19]. The successful implementation of SV during the delivery of infrastructure projects has continued to pose a challenge. This is particularly the case in the developing country where significant infrastructure deficits have been recorded. However, paucity of literature exists concerning studies seeking to investigate the ability of an IDS to deliver on optimal social value implementation in developing countries like Nigeria.

During the delivery of infrastructure, successful SV implementation occurs within an enabling project governance and organizational framework-the IDS [20]. These frameworks have been considered central to the implementation of project and/or client objectives and requirements [9, 20]. This study contributes towards bridging the research gap by analyzing the interrelationships existing between the barriers to SV implementation within these IDS using the NOGICD implementation exemplar in Nigeria's oil and gas industry using an interpretive structural modelling approach [ISM].

The rest of the paper is structured into 6 sections. Section 1 consists of a review of relevant literature concerning the contribution of infrastructure to economic growth, definition of the SV concept, the role of an IDS in SV implementation and the barriers to SV implementation in the IDS context. In section 2, the research method utilized in the study is described. Section 3 highlights the steps adopted during the development of the ISM model whilst the discussion of the emergent model is discussed in Section 4. The study's conclusion is presented in Section 6.

LITERATURE REVIEW

Unravelling the Contribution of Infrastructure to Economic Growth

The relationship between infrastructure and economic growth has been buttressed, severally [21, 22]. Studies highlight the nexus between the presence of adequate and resilient infrastructure stock and economic growth [22, 23]. Conversely, the absence of infrastructure will negate economic growth. Governments in emerging economies have devoted a significant proportion of capital expenditure towards infrastructure investments. Also developed economies like the United Kingdom have made considerable investments towards the development and redevelopment of infrastructure assets as a way of stimulating the local economy and engendering growth [24, 25]. Shi et al. [21] trace China's economic growth to the unprecedented increment in the nation's infrastructure expenditure. Kodongo and Ojah [5] attest to the influence of infrastructure spending on economic growth. More specifically, they reiterate the likelihood of access to infrastructure and quality thereof, to influence economic growth through trade competitiveness and capital flows across the borders.

Although there appears to be a consensus among various commentators and scholars on the important contribution made by the delivery of infrastructure to the local environment, there is a sharp dichotomy between those who believe that this economic contribution results from the impact of the completed asset on productivity, either directly or indirectly, and others who agree that whereas the finished asset does contribute towards enhancing the levels of productivity within the area, the process of procurement and subsequent delivery of these assets if properly organised and governed possesses the capability of contributing immensely towards achieving sustainable economic growth within the local economy as well. Proponents of the former school of thought posit that achieving a high degree of cost-effectiveness in the delivery of the infrastructure asset, particularly in austerity times, will allow for savings made to be ploughed into other economic activities [6, 26, 27]. Also, these authors argue that the decision on which infrastructure asset to be delivered in such instance would be hinged upon the perceived contribution of that particular asset to the growth of the local economy when compared to alternative projects.

Conversely, the proponents of the latter school of thought, in addition to the conditionalities stressed by the other school of thought, maintain that societal issues such as unemployment, paucity of skilled labour, ensuring low carbon footprints, the low rates of SMEs admissibility into the global and regional supply chains etc. can be addressed by infrastructure clients across the lifecycle of these projects [19, 28]. The power wielded by infrastructure clients during the procurement and delivery of these assets has been referred to as serving as a leverage for boosting SV implementation in projects [29]. Infrastructure Client Organizations [ICOs] through legislations are being tasked to drive the attainment of SV alongside other project success criteria like time, cost, and quality, when engaging with project teams and suppliers alike.

Understanding the Social Value (SV) Concept-

The term, 'Social Value' (SV) continues to defy a commonly accepted definition [11, 12, 14, 15]. Different scholars have sought to define the concept based on the expectations of the knowledge domain within which their work is situated [14]. For example, Wood and Leighton [29] defined SV as the 'soft' non-financial impact of organisations, programmes of work and investments, which may include, but is not limited to, communities, individual and, in some cases, environmental wellbeing. According to Cartigny and Lord [15], the Social Value Act (2012) views SV as the maximization of additional outcomes developed through the procurement of goods and services which surpasses the initial benefit of the goods and services themselves. As such, a widely accepted definition of SV remains mainly subjective. For this study, SV for public clients is defined as the additional outcomes accruing from infrastructure delivery programmes towards their local communities. Such outcomes range from employing local suppliers, using local workers, to creating sustainable apprenticeships opportunities, among others.

Whilst there are various facets for engaging with SV, this study focuses on the aspects prescribed in the local content development policy -the NOGICD Act as operationalized within the Nigerian Oil and Gas sector. These aspects consist of job creation, skills enhancement, local economic impacts, social investments, business ethics, security, diversity, etc. Therefore, this study unravels the relationships existing between the factors hindering successful SV implementation within IDS operating in the study's context.

Infrastructure Delivery Systems and Social Value Implementation

An IDS is described as an architecture which encompasses a plethora of interorganizational and multi-layered relationships existing between stakeholder organization involved with the various stages of the infrastructure delivery lifecycle [20]. The heightening complexity within the IDS is caused by the differences in the autonomy requirements of project participants and the degree of embeddedness within organisational and inter-organisational settings. These features demand the integration of project activities within organisation command and control routines and/or inter-organisational coordination efforts [30, 31]. These systems have been likened to project-based organizations (PBO). PBO structures have been described as effective models for managing projects in situations suggestive of increasing complexity like what obtains in the infrastructure sub-sector of the construction industry [32]. Scholars posit that a PBO like the IDS organise their structures, strategies, and capabilities around project needs which often cut across organizational and sectoral boundaries [31, 32]. The PBO structures and business processes are shaped around variables like the changing profile of projects, such as size, level of complexity, and the duration of such projects.

Based on the foregoing, the difficulty in implementing secondary objectives such as SV through such complex systems can be discerned. This difficulty is often occasioned by the inability of numerous stakeholder organizations to evolve a common ontology concerning the project objectives, especially when they are prescribed by legislation, within the IDS. But an IDS remains a veritable platform through which such objectives like SV can be readily implemented. As such, an understanding of the interrelationships existing between the factors with the potential to negate optimal SV implementation within an IDS will facilitate the development of an effective protocol for managing the implementation process. This is what this study set out to achieve. Also, the study demonstrates the utility of the interpretive structural modelling (ISM) approach as a management tool for showcasing the nature of interrelationships between SV implementation barriers. This illustration of the relationships allows system managers and administrators to decide on a logical, and cost-effective procedure for tackling these barriers.

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RESEARCH METHODOLOGY

The objective of this study is to determine the interrelationships existing between these barriers using the ISM. A detailed explanation of the ISM approach is provided in the study to enable replication. The study adopts a qualitative research approach wherein data collection was carried out using a focus group discussion forum [33]. The focus group discussion was conducted across a digital platform – Zoom- with a set of purposively selected discussants. A purposive, snowballing approach was adopted as a sampling technique for the identification and subsequent recruitment of discussants [34, 35]. Based on a set of criteria set by the author, 12 potential discussants were identified and approached via email. They were informed about the study's rationale and the role that they were expected to play in enabling the accomplishment of the study's objective. A reminder email was sent out to the same cohort after a fortnight interval. Three persons responded in the affirmative to the first round of emails whereas two more responded to the reminder email, indicating their willingness to participate in the focus group. Subsequently, the author implored them to identify and invite other persons who may be able to contribute to the study. This plea led to the inclusion of 3 more discussants, bringing the total number of discussants to 9. The demographics of the discussants is provided in Table 1.

TABLE 1
DEMOGRAPHICS OF DISCUSSANTS

No.	Organizational Role in IDS	Position of Discussant	Code	Years of experience
1	Infrastructure Client	Programme Director	PD	18
2	Infrastructure Client	Project Manager	PM	13
3	Regulator	Senior Manager – Nigerian Content	SM	10
4	EPC Contractor	Project Manager	EPM	15
5	EPC Contractor	Procurement Lead	EPL	20
6	EPC Contractor	Manager- Nigerian Content	MNC	9
7	Supplier (Construction/Earthworks Works)	Project Manager	SPM	15
8	Supplier (Piping/Tunnelling Works)	Site Engineer	SE	12

A doodle containing different dates and timeslots was created and emailed to the discussants to indicate their availability to participate in the Zoom meeting. In this instance, Zoom served as a typical synchronous online discussion forum [36]. Consensus was easily reached regarding the date and time for the discussion. The author communicated the date and timeslot to the discussants. They were also provided with a detail introduction to the study outlining the study's objectives, the list of barriers- see Table 2,as derived from the findings of a previous study seeking to identify factors influencing SV implementation in an IDS within the same study context. See Table 3.

TABLE 2
LIST OF BARRIERS

No.	Barriers	Description
1	Poor policy interpretation	The inability of representatives of the organizations working within an IDS to interpret sections of the NOGICD policy.
2	Poor information exchange	Non- adherence to communication pathways as established by the contract strategy adopted for the IDS.
3	Prevalence of Silo Knowledge	Unwillingness of organizations within the IDS share relevant knowledge between themselves
4	Poor collaboration	Lack of collaboration between public sector and private sector actors within the IDS
5	Poor government support	Absence of incentives like tax holidays, import duty waivers etc. to encourage private sector actors
6	Absence of industrial base in the local context	Lack of in-country manufacturing and industrial capabilities thereby necessitating importation
7	Ill-defined organisational identity	The absence of a common ontology among collaborating organizations within an IDS concerning SV-related project deliverables
8	Lack of transparency	Lack of clearly defined pathway for collaboration between the parties, particularly regarding procurement
9	Lack of access to funds	High interest rates which makes in-country borrowing less attractive and negates the competitiveness of local firms
10	Lack of resource capabilities	Absence of adequate and/or relevant plant and machinery stock in-country
11	Lack of skilled manpower	Absence of qualified personnel to carry out project-related activities
12	Poorly structured and managed supplier organisation	Non-existence of a well-structured project supply chain
13	Unnecessary complexity of the process	Duplication of regulatory processes between different public sector entities.

Source: Authors' compilation (2020)

TABLE 3
SV IMPLEMENTATION BARRIERS EXTRACTED FROM A PREVIOUS STUDY

	IDS1	IDS2
Barriers	Lack of agreement between members concerning definitions, interpretations and measurement criteria contained in the policy.	Lack of consensus observed between parties to the IDS about the appropriate criteria for measuring local content development performance
	Poor information sharing during supplier workshops.	No established platform for information exchange within the IDS.
	Prevalence of knowledge/information silos within the operator organization.	Not Observed
	Suppliers wrongfully though they were just beneficiaries of the successful implementation of the act rather than parties to the successful implementation.	Misinterpretation of the sections of the Act, particularly definitions.
	Absence of government encouragement (lack of incentives).	Lack of government support.
	Absence of industrial base in-country	Absence of industrial base in-country
	Ill-defined organizational identity for IDS1	Ill-defined organizational identity for IDS2
	Corruption and lack of transparency in the key processes	Allegations of corrupt practices among members of the delivery system
	Nigerian content ranked least in the selection of EPCM contractor by the Operator as cost effectiveness was more important than the engagement of local suppliers/labour	The EPC contractor did not favour Nigerian content development in the award of contracts.
	Lack of access to cheap funds by suppliers	Lack of access to affordable finance for the suppliers.
	Not Observed.	Late payment of suppliers
	Lack of resource capabilities to actively monitor progress of content development	Lack of effective apparatus for monitoring progress of content development
	Lack of skilled manpower	Absence of skilled manpower locally (In-country).
	Poorly structured and managed supplier organisations	Poorly structured and managed supplier organisations
	Requirement of performance bonds from suppliers	Requirement of performance bonds from suppliers
	Poorly structured and managed supplier organisations	Poorly structured and managed supplier organisations
	Presence of several agencies within System 4 performing the same functions contributed to unnecessarily complex processes.	Presence of several agencies within System 4 performing the same functions contributed to unnecessarily complex processes
	Not Observed.	No interorganizational interface between NigCorp and the Suppliers within IDS2

Source: Authors' compilation (2020)

The ISM protocol which the discussants were expected to discuss was included in this correspondence to prepare them before the scheduled discussion. An abridged version of the ISM protocol is provided in Table 3

TABLE 4
ABRIDGED VERSION OF ISM PROTOCOL

No.	Pairwise-relationship	Type of relationship	Response
1	Poor policy interpretation - Poor information exchange	Does poor policy interpretation influence poor information exchange	Yes/No
2	Poor policy interpretation- Prevalence of knowledge silos	Does poor policy interpretation influence prevalence of knowledge silos	Yes/No
3	Poor policy interpretation- Poor collaboration	Does poor policy interpretation influence poor collaboration	Yes/No
4	Poor policy interpretation-Poor government support	Does poor policy interpretation influence poor government support	Yes/No
5	Poor policy interpretation- Absence of industrial base in the local context	Does poor policy interpretation influence absence of industry base in the local context	Yes/No
6	Poor policy interpretation- Ill-defined organizational identity	Does poor policy interpretation influence ill-defined organisational identity	Yes/No
7	Poor policy interpretation- lack of transparency	Does poor policy interpretation influence lack of transparency	Yes/No
8	Poor policy interpretation- Lack of access to funds	Does poor policy interpretation influence lack of access to funds	Yes/No
9	Poor policy interpretation- Lack of resource capabilities	Does poor policy interpretation influence lack of resource capabilities	Yes/No
10	Poor policy interpretation- Lack of skilled manpower	Does poor policy interpretation influence lack of skilled manpower	Yes/No
11	Poor policy interpretation- Poorly structured and managed supplier organisation	Does poor policy interpretation influence poorly structured and managed supplier organisation	Yes/No
12	Poor policy interpretation- Unnecessary complexity of the Process	Does poor policy interpretation influence unnecessary complexity of the process	Yes/No

This is referred to as an abridged version because the complete version contains questions seeking a confirmation of the existence of a pair-wise relationship between each barrier and the remaining barriers or otherwise. The rules governing the interaction, particularly as it concerned anonymity and the recording of the session was disclosed in this communication. The discussants acquiesced to the guidelines and expressed their understanding of the task at hand. The discussion lasted for three hours during which the author acted as a facilitator. The extensive knowledge of the industry possessed by the discussants made the discussion an insightful one. The discussion followed the conventional focus group procedure. The facilitator inquired into the pair-wise relationships and the discussants gave their opinions concerning each relationship and proceeded to indicate their YES/NO verdict in the chat box. The author articulated these responses and deployed them towards the development of the ISM diagraph.

Interpretive structural modelling (ISM)

ISM is a qualitative and interpretive method to generate solutions for complex problems. It remains a valuable management tool due to the provenance of its ability to identify the importance of each variable with reference to the problem being investigated. Its utility for decision-making in organizations and projects alike has been noted [37]. The authors acknowledge the ability of the ISM to organize and link variables associated with a complex situation to facilitate a better understanding of the situation by using pair-wise comparison and transitive logic. The ISM methodology organizes a set of different directly related elements into a comprehensive structured model

According to Poduval and Pramod [38], the ISM method is characterized by the following attributes:

1. It is interpretive because the judgement of a certain group or experts decides whether and how the different elements are related;
2. It is structured according to the perceptions of a group of experts on the existence of a pair-wise relationship between variables;
3. The depiction of these relationships in a digraph model makes it a modeling technique;
4. It provides order and direction detailing as it were, the complexity of relationships among various elements of a system
5. It engenders a group learning process.

The utility of the ISM can be ascertained in any or a combination of the following instances:

1. When an understanding of the big picture and wider context are required
2. When it is difficult to know how to approach the problem
3. When understanding the interaction between the various issues involved in a situation has become imperative

The various steps involved in the ISM method are extracted from Poduval and Pramod [38] and Awuzie and Abuzeinab [39] and are as follows:

Step 1.
Identification of variables relevant to the problem. This can be done through secondary data or primary data such as interviews, survey or focus group

Step 2.
Establishing contextual relationship type such as influence or drive depending on the problem

Step 3.
Development of a structural self-interaction matrix (SSIM) by pair-wise comparison. This step will be carried out by experts on the problem context. The participants must decide upon the pairwise relationship between the variables. The existence of a relation between any two variables (i and j) and the associated direction of the relation is questioned. Four symbols are used to denote the direction of the relationship between the variables i and j:

V – for the relation from i to j but not in both directions - i ⟶ j
A – for the relation from j to i but not in both directions – j ⟶ i
X – for both direction relations from i to j and j to i; and i ⟷ j
O – if the relation between the variables does not appear to be valid i ⟷ j.

Step 4.
Reachability matrix is developed from the SSIM and the matrix is checked for transitivity. The transitivity of the contextual relation is a basic assumption made in ISM. It states that if a variable X is related to Y and Y is related to Z, then X is necessarily related to Z. Reachability matrix is a binary matrix since the entry V, A, X and O of the SSIM are converted into 1 and 0 as follows: V, X = 1 & A, O = 0

Step 5.
Classification of variables based on their driving and dependence power using MICMAC (Matriced'Impacts croises-multiplication applique' and classment) analysis

Step 6.
The reachability matrix obtained in step 4 is partitioned into different levels

Step 7.
Based on the relationships given above in the reachability matrix, a directed graph is drawn, and the transitive links are removed.

Step 8.
The ISM model developed in Step 7 is reviewed to check for conceptual inconsistency and necessary modifications are made.

PRESENTATION OF FINDINGS

Findings from the analysis of the focus group discussion forum shows the existence of contextual relationships requiring further analysis to structure the pattern of interrelationships between the barriers. The ISM approach was employed to achieve this structure

ISM model development

The application of ISM typically provided the stakeholder organisations operating within the IDS as represented by the discussants with a framework to reassess the perceived SV implementation barriers whilst improving their understanding of the linkages among key issues of concern. The ISM modelled the hierarchy of these barriers. The driver power-dependence matrix provided some valuable insights about the relative importance and interdependencies existing between these barriers. In this section, a detailed account of the conduct of the steps associated with the development of the ISM model is provided in subsequent sections.

Development of SSIM from Barriers

The views articulated by the discussants concerning the contextual relationships in the ISM protocol were reviewed based on 4 symbols ordinarily used for highlighting the relationship between any two barriers (i and j):

1. V: factor i will influence factor j but not in both directions;
2. A: factor j will influence factor I but not in both directions;
3. X: factor i and j will influence each other; and
4. O: factor i and j are unrelated.

The focus group discussion feedback was used to develop the structural self-interaction matrix (SSIM) based on the relationships identified. See Table 5. From the emergent SSIM, the absence of a relationship between some barriers (i.e. with a symbol of O) can be discerned.

The SSIM was consequently converted to binary values by substituting V, A, X and O with 1 and 0 per case to develop the initial and final reachability matrix.

The rules for such substitution are provided below:

1. If the (i, j) entry in the SSIM is V, then the (i ,j) entry in the reachability matrix becomes 1 and the (j, i) entry becomes 0.
2. If the (i, j) entry in the SSIM is A, then the (i, j) entry in the reachability matrix becomes 0 and the (j, i) entry becomes 1.
3. If the (i, j) entry in the SSIM is X, then the (I ,j) entry in the reachability matrix becomes 1 and the (j, i) entry also becomes 1.

If the (i, j) entry in the SSIM is O, then the (i, j) entry in the reachability matrix becomes 0 and the (j, i) entry also becomes 0. See Table 6

TABLE 5
STRUCTURAL SELF-INTERACTION MATRIX (SSIM)

Barriers		B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13
Poor policy interpretation	B1	V	X	V	X	X	O	O	V	V	O	O	V	X
Poor information exchange	B2	X	X	X	X	X	O	O	A	A	A	A	A	A
Silo knowledge	B3	X	X	V	X	X	V	X	X	O	O	O	X	A
Poor collaboration	B4	X	X	X	V	X	O	A	A	O	A	A	A	A
Poor government support	B5	X	X	O	X	V	V	O	X	V	X	X	O	X
Absence of industry base in the local context	B6	O	O	A	O	A	V	A	A	A	A	A	O	A
Ill-defined organisational identity	B7	O	V	X	V	O	V	V	O	O	O	O	O	O
Lack of transparency	B8	A	V	V	V	V	V	O	V	X	O	O	V	A
Lack of access to funds	B9	O	O	O	O	A	V	O	X	V	V	V	V	A
Lack of resource capabilities	B10	O	V	O	V	A	V	O	O	A	A	X	V	A
Lack of skilled manpower	B11	O	V	O	V	O	V	O	O	A	V	V	X	O
Poorly structured and managed supplier organisation	B12	A	V	V	V	O	O	O	A	A	A	A	V	O
Unnecessary complexity of the Process	B13	X	V	V	V	X	V	O	V	V	V	O	O	V

Source: (Author's fieldwork, 2020)

TABLE 6
FINAL REACHABILITY MATRIX

Barriers		B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	Driver Power
Poor policy interpretation	B1	1	1	1	1	1	0	0	1	1	0	0	1	1	9
Poor information exchange	B2	1	1	1	1	1	0	0	0	0	0	0	0	0	5
knowledge Silo	B3	1	1	1	1	0	1	1	1	0	0	0	1	0	8
Poor collaboration	B4	1	1	1	1	1	0	0	0	0	0	0	0	0	5
Poor government support	B5	1	1	0	1	1	1	0	1	1	1	1	0	1	10
Absence of industry base in the local context	B6	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Ill-defined organisational identity	B7	0	1	1	1	0	1	1	0	0	0	0	0	0	5
Lack of transparency	B8	0	1	1	1	1	1	0	1	1	1*	1*	0	0	9
Lack of access to funds	B9	0	1	0	1	0	1	0	0	1	1	1	1	0	7
Lack of resource capabilities	B10	0	1	0	1	0	1	0	0	0	1	0	1	0	5
Lack of skilled manpower	B11	0	1	0	1	0	1	0	0	0	1	1	1	0	6
Poorly structured and managed supplier organisation	B12	0	1	1	1	0	0	0	0	0	0	0	1	0	4
Unnecessary complexity of the Process	B13	1	1	1	1	1	1	0	1	1	1	0	1	1	11
Dependence		6	12	8	12	6	9	2	5	5	6	4	7	3	85/85

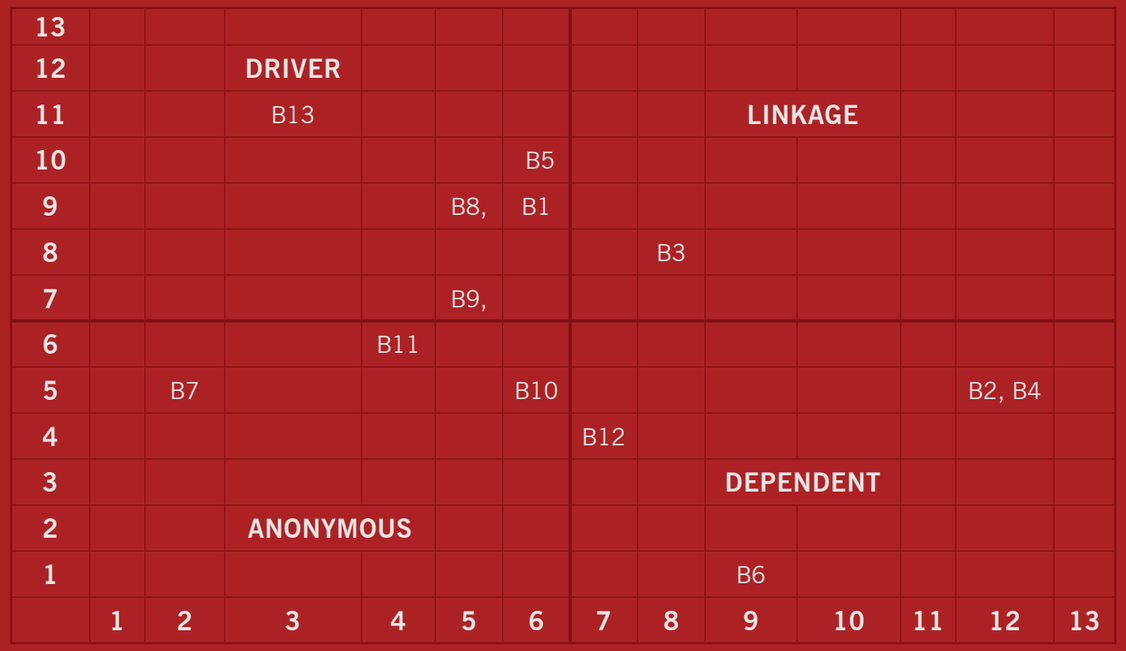
Source: (Author's fieldwork, 2020)

Classification of SV implementation barriers – MICMAC analysis

The 13 barriers are subsequently analysed using the Matriced'ImpactsCroises-Multiplication Appliqúe an Classement (MICMAC). The MICMAC ascertains the degree of the relationships between the various factors using the power and the dependence matrix.

The sum of scores along each corresponding row determines the power of a driver, whereas the sum of the scores along each corresponding column determines the dependence of a driver. The MICMAC uses scores from the final reachability matrix Table 6 for analysis. The MICMAC result classifies the barriers into four clusters. See Figure 1. The MICMAC categorises factors into independent, linkage-dependent, and autonomous clusters.

FIGURE 1
DRIVING POWER AND DEPENDENCE DIAGRAM



Source: (Author's construct, 2020)

The MICMAC analysis results show the following:

1. The barriers located in the independent cluster are B1, B13, B8 and B9 and B5. The independent cluster contains strong factors with weak dependence.

   Hence, highly relevant for consideration by the strategic organisations because they possess the capability to influence other factors in the system. These factors can therefore be considered fundamental barriers negating SV implementation performance.

2. The barriers located in the dependent cluster are B2, B4, B12 and B6. The factors in the dependent cluster contain weak factors with strong dependence which means that they need support from other barriers in the system to influence SV implementation. These barriers can be considered as outcome or resultant factors because they depend on other factors from the base of the ISM model.

3. The barriers located in the autonomous cluster are B7, B10, B11. The autonomous cluster which contains weak and dependent barriers, though they may have a few strong links that are relatively disconnected from the system. These barriers have little influence on SV implementation performance because they are either not powerful to facilitate others or depend on others to function and so can be overlooked.

4. Finally, B3 is in the Linkage cluster. The linkage cluster contains factors that are both strong and dependent. These factors are deemed unstable, as any action on them could affect them and other factors in the system.

From the final reachability matrix, the level partitions are established. These partitions are assigned following the iteration process of the factors (Tables 7-10). When the reachability set consists of the driver itself and other driver(s) that it may facilitate) and the intersect set are same 40,41, a level is established. Iterations were conducted and any level partitioned is subsequently removed from further consideration. This process is continued until the levels of all the factors are established. The iterations are as presented in Tables 7-10.

TABLE 7
ITERATION 1

Barriers	Reachability	Antecedent	Intersection	Level
B1	1,2,3,4,5,8,9,12,13	1,2,3,4,5,13	1,2,3,4,5,13	
B2	1,2,3,4,5	1,2,3,4,5,7,8,9,10,11,12,13	1,2,3,4,5	|
B3	1,2,3,4,6,7, 8,12	1,2,3,4,5,7,8,10,12,13	1,2,3,4,7,12	
B4	1,2,3,4,5	1,2,3,4,5,7,8,10,11,12,13	1,2,3,4,5	|
B5	1,2,4,5,6,8,9,10,11,13	1,2,3,4,5,8,13	1,2,4,5,8	
B6	6	3,5,6,7,8,9,10,11,13	6	|
B7	2,3,4,6,7	3,7	3,7	
B8	2,3,4,5,6,8,9,10,11	1,3,5,8,9,13	5,8,9	
B9	2,4,6,8,10,11,12	1,5,8,9,13	8	
B10	2,4,6,10,12	5,8,9,10,11,13	10	
B11	2,4,6,10,11,12	5,8,9,10,11	10,11	
B12	2,3,4,12	1,3,9,10,11,12,13	3,12	|
B13	1,2,3,4,5,6,8,9,10,12,13	1,5,13	1,5,13	

Source: (Author's construct, 2020)

TABLE 8
ITERATION 2

Barriers	Reachability	Antecedent	Intersection	Level
B1	8,9, 13	13	13	
B3	7	7,8,10,13	7	||
B5	8,9,10,11,13	8,13	1,2,4,5,8	
B7	7	7	7	||
B8	8,9,10,11	8,9,13	8,9	
B9	8,10,11	8,9,13	8	
B10	10	9,10,11,13	10	||
B11	10,11	9,10,11	10,11	||
B13	8,9,10,13	13	13	

Source: (Author's construct, 2020)

TABLE 9
ITERATION 3

Barriers	Reachability	Antecedent	Intersection	Level
B1	8,9,13	13	13	
B5	8,9,13	8,13	8,13	
B8	8,9	8,13	8,9	III
B9	8	8,9,13	8	III
B13	8,9,13	13	13	

Source: (Author's construct, 2020)

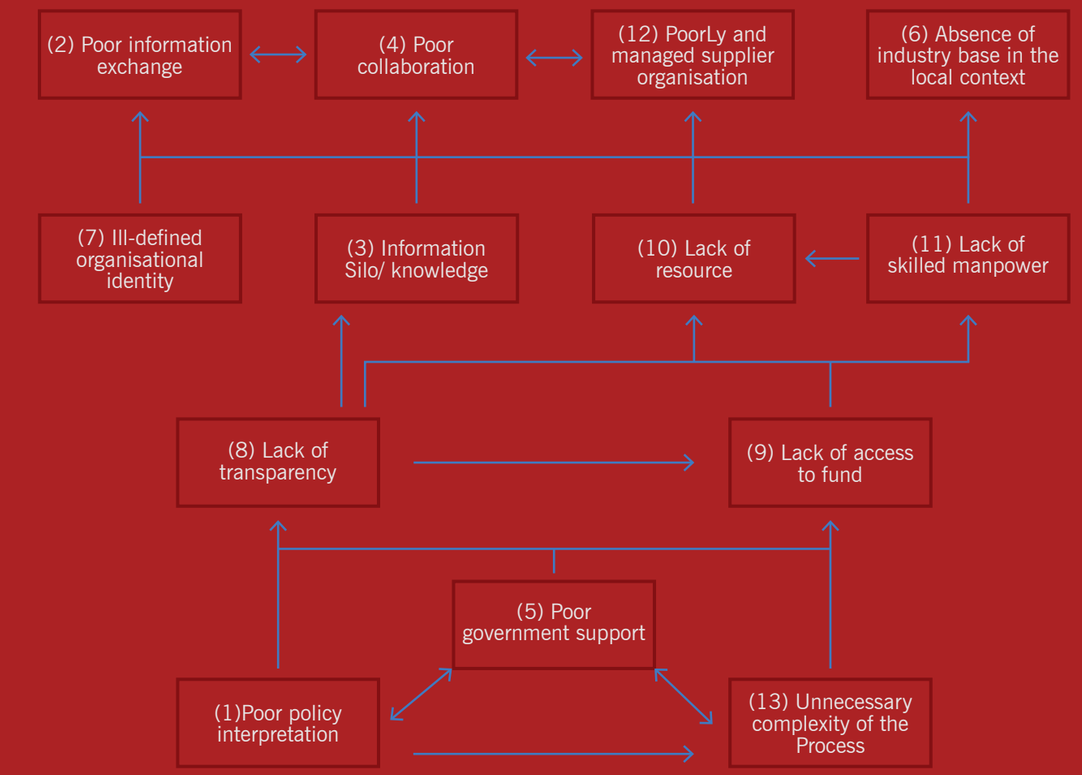
TABLE 10
ITERATION 4

Barriers	Reachability	Antecedent	Intersection	Level
B1	13	13	13	IV
B5	13	13	13	IV
B13	13	13	13	IV

Source: (Author's construct, 2020)

From the level partitions, and an ISM diagraph highlighting the nature of interrelationships existing across multiple (4) levels was developed. See Figure 2

FIGURE 2
ISM DIAGRAPH



Source: (Author's construct, 2020)

The extant interrelationships between the various SV implementation barriers as provided in Figure 2 are explained below.

Unnecessary complexity of the Process (B13), Poor government support (B5), and Poor policy interpretation (B1) are located at the base of the ISM model. These barriers have bilateral links whereas facilitating each other and are highly relevant barriers driving poor SV implementation in the IDS as they drive other barriers both directly and indirectly. B13, B5 and B1 as shown, directly facilitate lack of access to funds (B9) and lack of transparency (B8) on Level 3. At Level 3, where, the lack of access to funds (B9) and lack of transparency (B8) are located. B8 and B9 both have bilateral links and are connected directly to the base. B8 have direct connections to three barriers in Level 2 (B3, B10 and B11) while B9 only facilitates two barriers (B10 and B11).

Four barriers namely (B3) Silo knowledge, (B10) Lack of resource capabilities, (B11) Lack of skilled manpower, and (B7) ill-defined organisational identity are located at

Level 2. B10 and B11 have bilateral links but do not have any interaction with B7 and B3. Furthermore, B7 has no connection to the base of the ISM model. However, all four barriers directly facilitate the occurrence of barriers at Level 1. At Level 1, four factors, (B2) Poor information exchange (B12) Poorly structured and managed supplier organisation and B4 Poor collaboration (B6) Absence of industrial base in the local context are located. B2, B4, and B12, B4 have bilateral relationships however B6 has no direct interactions with B2, B12 nor B6 at Level 1. These three factors all depend on all other factors from the base of the ISM diagraph within the IDS.

Discussion of Findings

Summarily, the study's findings reflect the current views of stakeholders on the interrelationships between 13 barriers negating optimal SV implementation performance of the IDS. Extant studies have sought to explore the barriers to SV and social procurement implementation on construction projects across the globe. For instance, Awuzie and McDermott [20] deployed a viable systems methodological framework -the Viable Infrastructure Delivery System Model- (VIDSM) to carry out a comprehensive diagnosis of an IDS to determine SV implementation barriers. Loosemore et al [42] and Hurt-Suwan and Mahler [28] highlighted the barriers confronting effective implementation of social procurement, especially as it affects the inclusion of disadvantaged populations in the Australian and New Zealand contexts, respectively. Also, Ogunsanya et al. [43] have identified the barriers negating sustainable procurement- a phenomenon which shares some semblance with SV- within the Nigerian construction industry. Similarly, Wirahadikusumah et al.[44] established factors- inclusive of barriers-influencing the incorporation of sustainability principles on construction projects. Alotaibi et al. [45] also established the critical barriers negating social responsibility implementation within mega-construction projects in Saudi Arabia. Also, a plethora of studies have deployed the ISM to carry out an analysis of related phenomenon like barriers of sustainable practices implementation [46], barriers to the implementation of corporate social responsibility practices in construction organizations [47] and for analyzing the barriers to green supply chain implementation in construction organizations. But there are no studies known to this author which have sought to carry out an ISM analysis of SV implementation barriers within an IDS. This is indeed a salient contribution to the project management and governance literature as well as the SV in construction knowledge domain and beyond.

The use of the ISM facilitated the structuring or a hierarchy relationship of the barriers thereby aiding the design and development of the model. The relationship of these barriers as depicted in the model shows that poor policy interpretation, poor government support as well as unnecessary complexity of the process will directly lead to lack of transparency and access to funds in the process with further links to all the other factors in the IDS process. With the lack of transparency and access to funds in the process development of information silos, lack of skilled manpower as well as resource capabilities is inevitable. Consequently, poor collaboration, poor information exchange, poorly structured and managed supplier organisations and absence of industry base in local context becomes the results that would be experienced. These resultant outcomes as shown at the stop of the model hierarchy are often highlighted as the challenges but in fact are result of other actions operating within the system. Findings from the study show that poor policy interpretation, poor government support as well as unnecessary complexity of the process are the main sources of the challenges experienced within the IDS hence, both project sponsors and the management must consider these three barriers.

Conclusion

This study set out to analyze the interrelationships existing between SV implementation barriers. It leveraged on the barriers which had been identified in a previous study which focused on the implementation of an SV variant, a local content development policy governing capacity development among indigenous entities and in Nigeria's oil and gas industry. The instrumentality of the ISM was brought to bear in engendering the analysis utilizing data elicited from a focus group discussion group comprising of key role players in the IDS operating within the sector. The analysis of these SV implementation barriers established the criticality of certain barriers whilst relegating some barriers as being non-critical. Also, it highlighted the dependence of certain barriers on other barriers whilst presenting autonomous barriers accordingly.

Findings from the study highlight the criticality of poor policy interpretation, poor government support and unnecessary complexity of relevant processes as critical SV implementation barriers. This study holds significant implications for policy makers and industry practitioners as it provides them with valuable insight into the nature of relationships between SV implementation barriers. Such knowledge will assist in the development of protocols for engendering successful SV implementation in the IDS.

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