

## EFFECTS OF DISSEMINATION PRACTICES ON ORGANISATIONAL CHANGE TO ADOPT SUSTAINABLE CONSTRUCTION

SAMUEL EKUNG\*<sup>1</sup>, ANTHONY UJENE<sup>2</sup> AND MONDAY OTALI<sup>2</sup>

<sup>1</sup>Department of Quantity Surveying, <sup>2</sup>Department of Building, University of Uyo, Uyo, Nigeria.

\*Corresponding author: [elbason6@gmail.com](mailto:elbason6@gmail.com)

**Abstract:** The disseminating innovation within the construction sector has been increasingly linked with organisational performance. Limited research, however, exists on the effects of dissemination practices on organisational structuration to embed innovation. This paper addressed this gap by focusing on the effects of dissemination practices on organisational change to embed sustainable construction practices (SCP). Using survey data obtained from (135) construction stakeholders in South-South, Nigeria, canonical correlation analysis was used to determine the correlational effect of dissemination practices on organisational change to embed SCP. The study showed that a combination of different dissemination practices was directly related to knowledge internalisation, socialisation, externalization and combination across the firm's structure. Positive organisational change to embed SCP was however, best developed using exemplar projects, case studies and cluster briefing. Stakeholders were enjoined to focus on developing real-life sustainable projects using integrated practices, where they could be deployed to deeply embed related knowledge across the industry. This research results signal an important departure from unbalanced interests in knowledge transfer performance rather than the performance of knowledge transfer mediums. The study, therefore, bridges the gap in pedagogical issues affecting the learning of sustainable construction and associated knowledge transfer.

Keywords: Dissemination practices, knowledge processes, structuration, sustainable construction practice.

### Introduction

The need to develop new skills within the construction industry has witnessed invigorated interest in the growing requirement to embed sustainability practices within the sector. Knowledge in sustainable construction practices (SCP) is needed to develop the 'know-how' to promote resource efficiency in the creation of a healthy built environment (Kibert, 2013). The skills required to advance this goal are, however, deficient in many perspectives (Gleeson & Thompson, 2012; Nduka & Ogunsami, 2015). Due to the lack of skills, a construction organisation's commitment to apply SCP becomes lagging and optional (Heffernan *et al.*, 2012; Hwang *et al.* 2017). Effort across the construction industry to develop strategies to narrow the skills gap has also not generated adequate pedagogies to improve knowledge dissemination. Rather, the skills deficit continues

to receive alarming publicity in focal press, notably in developed economies (UKCES, 2013). In developing economies, low skills training and dissatisfaction of stakeholders with the trained workforce are also alarming (Chindo *et al.*, 2015). Despite this gap, insignificant attention has been reportedly given to skills training related to sustainable construction in construction manager's training in Nigeria (Bejide & Iyagba, 2015).

The term "dissemination" is a planned process of understanding potential adoption and engagement with learned knowledge to ensure commitment and sustained transformation (Gannaway & Hinton, 2011). Dissemination empowers the learner's transfer of innovation to improve practices (Trushell & Eqware, 2015). A study by Murray (2009) observed that the motivation to learn and learning dissemination were positively correlated. Dissemination

practices, therefore, have a mediating role in learning effectiveness and organisational readiness to embed new innovations (Murray, 2009; Trushell & Equare, 2015).

Although learning dissemination has been extensively researched in human resource management (Rabin *et al.* 2008; Bywood *et al.* 2008; Gumilar & Goblon, 2013), sustainable construction literature has, however, done very little to theorise the performance of dissemination practices in knowledge integration at organisational level. Studies related to sustainability learning only emphasised skills and knowledge dearth and the need to improve these areas through training (Gleeson & Thompson, 2012; Hwang *et al.* 2017). This study clarifies that the dearth in skills and the advocacy to address it are not new. Continuous professional development framework of respective professional bodies in the built environment is designed to meet skills needs of members. At the academic level, sustainability concerns are increasingly incorporated within academic curricula in the built environment (Gelengis & Harris, 2014). However, there is limited literature in investigating the performance of pedagogical practice, mode of learning and learning dissemination practices (Oliveira & O'Flynn, 2015). Structured empirical study is, therefore, desirous to address issues related to learning dissemination practices and their impact on organisational transformation to embed and adopt SCP. According to Baker *et al.* (2015), the quest for improved research into knowledge dissemination practices persists in many industries. Limited empirical evidence further exists about the influence of dissemination practices on knowledge transformation processes in embedding sustainability innovation in construction organisations (Bresnen *et al.*, 2005; Sepasgozar, Davis & Loosemore, 2018).

This study evaluates the effects of learning dissemination practices on organisation structuration to embed SCP. The objective is to determine the correlation between dissemination practices and organisational

structuration in applying SCP. The knowledge of the relationship between dissemination practices and organisation's structuration to apply SCP is theorised to benefit the industry in a number of ways. The outcome of the study exposes inferred stakeholders to adopt appropriate models to ensure that new skills and knowledge are effectively embedded and translated to practice. Studies have also shown that sustainability objective are only achievable through possessions of requisite knowledge and expertise (Rezgui & Ferneley, 2005; Gleeson & Thompson, 2012). Effective dissemination of construction project knowledge is also imperative in improving organisational learning (Senaratne *et al.*, 2017). In addition, the capacity to curb varying challenges faced by the construction industry is linked with effective dissemination, adoption and implementation of new innovations (Welch *et al.*, 2015). Viable information about key variables of sustainable construction are also prerequisite strategies to promote their adoption (Chan *et al.*, 2017), while knowledge dissemination is the constituent characteristic for championing innovation in the construction industry (Kulatunga *et al.*, 2011).

### ***Sustainable Construction***

The term was first defined by Kibert in 1994 during the first International Conference on Sustainable Construction as "the creation and responsible management of a healthy built environment based on resource efficient and ecological principles" (Kibert, 2013). Sustainable development in construction is addressed under its three cardinal components, namely environmental, social and economic goals. Only a few studies, however, embedded each dimension within the activities of the construction sector. The consensus tends to measure sustainable construction using six main principles: reduction in resource use, encouraging resource reuse, use of renewable and recycled materials, protect the environment, ensuring quality in delivering built assets and maintaining a healthy and non-harmful environment (Khalfan *et al.*, 2012).

These objectives only meet the requirements of environmental sustainability (Higham & Fortune, 2012).

### ***Theory of Dissemination***

The term dissemination is applied to depict real flow of information between two ends — the source and the audience (Marriot *et al.*, 2000). This indicates that information flow is direct, organised, planned, on target and addresses specific needs of the audience. In business literature, dissemination is linked to knowledge diffusion (Eresia-Eke & Makore, 2015), where words such as “knowledge transfer”, “knowledge flow” and “knowledge sharing” are used interchangeably (Yang, 2007; Makore & Eresia-Eke, 2014). Makore and Eresia-Eke (2014) described knowledge dissemination as circulation of approved knowledge across an organisation. Dissemination is, therefore, concerned with embedding knowledge across the structure of an organisation with a view to apply them to modernised existing practices. This understanding portrays dissemination as a process of converting advances in practices within an organisation context (Welch *et al.*, 2015).

SCP, as a body of knowledge, fulfils the characteristics examined above. They advocate a complete departure from the conventional way of building design and construction, thereby representing new practices. Dissemination is, therefore, imperatively used to improve awareness about their unique information or knowledge relating to defined aspects of SCP. Dissemination is targeted to stimulate implementation and change in construction stakeholder’s behaviour (Marriot *et al.*, 2000). However, dissemination itself is not conditioned to achieve these benefits in isolation, but in connection with the strategies (practices) adopted.

The effectiveness of dissemination is also designed around three variables, namely the environment, the audience and the message. The context of environment is relevant based on three theories: social influence, flow hypothesis

and information transfer (Marriott *et al.*, 2000). The social influence indicates that personal attitude is conditioned by influences posed by people in the environment. The flow hypothesis explains that information flow and embedding occur in stages and are faster when peer influence is enlisted. This theory emphasises the roles of local agents and media, impressing that opinion leaders are related directly in forming novel views. Information transfer enlists two models: diffusion and dissemination. Diffusion of knowledge is dispersed and untargeted, while dissemination is more organised, target oriented, practical and planned (Welch *et al.*, 2015).

The context of an audience is predictable from the theory of communication. The audience is specific, pre-empted and planned. It is important to identify who needs to know. A vast proportion of sustainable development policies is targeted at specific industries and integrated professional disciplines working cohesively in collaborative ways. Marriot and co-workers (2000) maintained that because knowledge is shared across the board, parties outside the project team may also benefit from the information disseminated by the team’s network.

Lastly, the message must be rich in content, emanate from credible source and the channel of dissemination must be effective. The attributes of viable source of knowledge include credibility and close proximity (Marriot *et al.*, 2000). Credibility is measured by the level of authority and honesty. Proximity, on the other hand, is predicated on the ability to adapt the knowledge to local protocols and applications. When this position is contextualised to sustainable construction, it is noted that sustainability paradigms vary along regional and locational contexts, its practices are essentially context-specific and is embedded using local construction practices. This means that local practitioners must accept that developing practices are relevant to the local environment, before dissemination can take place. In addition, the content of disseminated knowledge must be brief, clear and consistent with local and existing

beliefs and attitudes. The dissemination channel must exhibit opportunities for systematic instructions and appropriateness to a target audience.

### ***Dissemination practices***

Various dissemination mechanisms are available, but the choice and performance of each strategy varies with the targeted audience and message. These include technical and non-technical reports, peer reviewed publications, professional journals, newsletters, face-to-face communication and workshops and seminars. Others include informal networks, action research, dissemination protocols, excursions, training courses and regular forums (Holmes and Savgard, 2008). A study by Quimpo and Neufield (2007) identified the following dissemination strategies: workshops, seminars, panel discussions, technical presentation and information sessions.

Technical reports present knowledge in terms of regulatory and policy agenda underpinning them, thereby outperforming peer reviewed journals and other scientific publications. Technical reports, however, require factual information, are resource intensive, address a limited audience and can be censored by employers (Holmes and Savard, 2008). Non-technical reports, on the other hand, are consistent, may capture the relevant policy and can make recommendations. Studies have argued that non-technical reports are often times inconclusive, suggesting more research are necessary and limits the basis behind the results. Peer reviewed publications are relevant to the scientific community only. The quality assurance in peer reviewed publication is high but involves a long-time scale. Other professional journals relevant to a particular trade or profession are also effective but will not score greatly. The Internet is broad-based, but there are quality concerns and accessibility problems in online literature. The dimension of computer literacy and challenges of unauthorised information infraction and safety concerns are also significant problems with the use of Internet as a dissemination tool.

Newsletters are an intra-organisational tool used to provide up-to-date developments about internal operations. Workshops and seminars are widely conducted by industries. Both strategies can be employed to discuss the results of an investigation. However, these strategies are tied to high cost and apathy among senior industry members to attend seminars and workshops is very high. Panel discussion is also widely used to interface between proponents of new ideas and experts and practitioners in the industry.

Dissemination practices are classified based on the objective of dissemination targeted by the user. Dissemination for awareness enlists tools such as person-to-person interfacing, cluster briefing, emailing and web publishing (King, 2010). Dissemination for understanding is achieved mainly through research publications, scientific literatures and dedicated journals, conferences, workshops, symposia, exhibition fairs and other clustering activities (Gumilar & Goblon, 2013). Dissemination for action, on the other hand, enlists strategies such as case studies, exemplar projects and even events that create a community of practice, such as workshops, integrated practices, seminars and conferences (Gunnaway & Hinton, 2011). The study headlines thirteen dissemination practices in examining the relationship between dissemination practices and organisational change to embed SCP.

### ***Theory of Structuration***

Originally, the structuration theory is designed to determine the extent to which individual responses influence firm structural elements in making changes imposed by externalities. The boundary of the structuration theory is now extended to evaluate the influence of strategies used to introduce new practices on knowledge processes among the human capital components of the firm. According to Bresnen *et al.* (2005), the principal interests of structuration is to tackle the correlation between the individual agency and society. It, nonetheless, offers a veritable frame of reference for evaluating institutionalisation and integration of

knowledge in social structures. Structuration suffices that human responses are correlations of forward and backward interaction between firm structures and individual agencies. Relating the above position to the implementation of SCP innovation, the theory explains that for new practices to generate the needed change, conventional construction practices must be suspended or modified simultaneously as new ones are accepted by the organisation (Giddens, 1990).

The structural dimension of the firm comprised of rules and resources. Earlier work by Giddens in 1984 had distinguished two varieties of rules, namely interpretative and normative. Interpretative rules generate the procedure used by the firm's elements in sense-making and action. Normative rules, on the other hand, are known as legitimisation rules (Giddens, 1990), that define the action of the firm on which is acceptable and legitimate. Normative rules dictate the firm's decision to act responsibly to safeguard the environment by adopting SCP. The resource dimension empowers interaction in the organisation based on expertise, or social networks, as well as economic resources. These mechanics contribute to the way the firm's elements act on new innovation. The interpretative and normative rule governance and resources imply that organisational change to adopt SCP is procedural, rule-based and an ethical responsibility at the same time, which requires some level of empowerment using both economic and authoritative resources.

In summary, structuration conceives organisational change to adopt SCP as a product of multi-faceted, opposing, interaction between individual agencies and the firm's structural features. The human capital within the firm is patterned to promulgate and reproduce these interactions. As a result, embedding new project practices is not only derived from a firm's condition, but by interpretative and normative rules and resources and how actors within the firm make sense of knowledge to create new practice. To achieve successful knowledge integration, it is important to synthesize structural elements of

the firm on one hand and localised knowledge-based working practices on the other. The implication is that knowledge dissemination deals more with preferred dissemination practices by actors than extended comprehensive knowledge management practices (Bresnen et al., 2005). Fernie et al.(2006) applied the structuration theory to critically examine change in construction organisation management, while Bresnen et al.(2005) used the theory to study change implementation in construction organisations.

### ***Relationship between organisational change to innovation and dissemination practices***

The commitment to change is determined by the end-user's involvement in the dissemination of new practices (Southwell et al. 2010; Gumilar & Gablon, 2013). Bywood et al. (2008) imported the commitment of a paradigm change to evaluate the level of organisational change adaptation. According to Bywood et al. (2008), implementation of innovation consists of information distribution through learning, obtaining support from learner's institution (empowerment to effect change) and appropriate organisation climate to effect change. This study develops from the first premise, which deals with information distribution. It, therefore, proposes that the effectiveness of organisational embedding of knowledge is varied based on the characteristics of strategies used, their competitive advantage and characteristics of the adopter.

The seminal works of Nonaka and Takeuchi (1995) presented four stages in knowledge dissemination cycle, which are socialisation, externalisation, combination and internalisation. This model of innovation dissemination, however, revolves around the types of knowledge namely tacit ad explicit, which is not considered in this study. Therefore, the level of an organisation's readiness to adopt new knowledge is hypothesised to depend on the extent to which the new knowledge is internalised, externalised, combined and socialised. Socialisation means dissemination of tacit knowledge between

individuals in the organisations, externalisation involves transforming tacit knowledge to explicit knowledge, combination means that individuals add to self-acquired explicit skills to already created ones and internalisation depicts conversion of explicit knowledge to tacit knowledge based on repeated practices (Nonaka & Takeuchi, 1995; Eresia-Eke & Makore, 2015). Dissemination is, therefore, primarily directed at eliciting change in behaviour or action of the targeted population (Marriot, Palmer, Lelliott, 2000). This is implying considerate level of overlap between knowledge dissemination and implementation. Both dimensions, therefore, operate in continuum since appropriate awareness and understanding are essential prerequisites for changing behaviour.

Eresia-Eke and Makore (2015) linked the effectiveness of knowledge dissemination to holistic organisational performance. Their seminal work buttressed knowledge dissemination as a solution to a company's losses by enabling transformation of shared knowledge to organisational competencies. Organisational competencies reside in the firm and individuals and they are the skills that generate competitive advantage (Mitchell & Boyle, 2010). Organisational transformation to adopt SCP, therefore, means that both the firm's structure and processes and employee characteristics, such as skills, knowledge and experience, are well modified (Eresia-Eke & Makore, 2015).

Similarly, based on knowledge-based theory, knowledge transfer to practice is dependent on the level of knowledge resident in the organisation's human capital and the level of knowledge processes development as the basic element of knowledge integration. The study by Senaratne *et al.* (2017) reported that the level of interaction between various elements of the organisation influences the dissemination of project knowledge. Sepasgozar *et al.* (2018) showed that innovation dissemination strategies are dependent on the type of innovation and characteristics.

The necessity for firms to modify and embed innovative practices to foster competitive advantages is not new. The calls for change in the way construction business is conducted is consistent in many innovation reports, including Latham and Egan. Since these reports were published, an increasing number of studies has been dedicated to measure various aspects of paradigm change. One of the key change drivers is transitioned to adopt innovative practices to improve success and, more broadly, enhance knowledge management as the fundamental driver of increased productivity (Bresnen *et al.*, 2005). Although, knowledge management dimensions are diverse, the aspect of how firms change their practices and the performance of knowledge embedding processes has not witnessed much empirical investigation. Since according to knowledge-based theory, knowledge transfer to practice is conditioned on the extent of knowledge possessed by the firm's human capital, the stages in knowledge dissemination cycle, therefore, portray an appropriate yardstick to determine the effectiveness of knowledge dissemination practice.

### Materials and Methods

The study engaged construction stakeholders in an analytical survey. The goal was to explore the correlation between dissemination practices and organisation change in adopting SCP. The study involved randomly selected professionals in construction organisations in South-South, Nigeria, including architects, builders, engineers and quantity surveyors. To aid sampling using a scientific approach, preliminary inquiries into the archives of respective professional bodies were carried-out. The search found 760 construction professionals listed in the directory of Nigerian Green Building Council in South-South, Nigeria. This population was subjected to sample size determination formula developed by Kish in 1965 and following the protocols of Enshassi, *et al.* (2012) to obtain 135 samples. This sample size included additional 50 % of samples aimed at correcting the effect of non-

response bias. The strategy had been used to improve and adjust the sample size for non-response bias across studies (Kelfve *et al.*, 2013; Corry *et al.*, 2017; Brick & Tourangeau, 2017).

The research used a structured questionnaire to obtain the data. The choice of survey and research instrument was driven primarily by the need to achieve breadth in sampling a vastly dispersed population. Moreover, the strategy (survey using questionnaire) had witnessed widespread application in many related studies (Barrela & Watson, 2015; Nduka & Ogunsami, 2015), including other large-scale institutional studies such as the World Green Building Trend (2016). The questionnaire consisted of four questions — three were related to the respondents' experience, qualification and roles in their organisations. The fourth determined the effects of dissemination practices on organisational change to embed SCP. All questions enlisted multiple-choice answers and respondents were required to select the variables. Questions relating to the effect of dissemination practices on organisation change to adopt SCP was constructed using a five-point Likert scale, where "1" indicated very low impact and "5" indicated the highest point corresponding to very high impact. The mean item score, percentages and canonical correlation analysis were used to analyse the data. Canonical correlation analysis was used to determine the correlation between dissemination practices and organisational change to adopt SCP. The tool was, therefore, used to test the study's hypothesis, which stated that dissemination practices had no significant

correlational effects on organisational change to adopt SCP.

The tests statistics associated with canonical correlation adopted in the study included canonical co-efficient, multivariate tests of significance (Wilks, Eigenvalue and F-values) (Warner 2008; Dattalo, 2014). The tests were considered significant when  $P < 0.05$ . Dimensions of reliability of measurement constructs were evaluated using Cronbach Alpha (using 0.70 cut-off point, Pallant, 2010).

## Results and Discussions

### Respondent characteristics

Ninety-five valid responses were retrieved and the study obtained a response rate of 70.37 %. This was significant and adequate for a regional-based survey. The high response rate further indicated that the additional 50 % correction samples for non-response were effective. In addition to information on questionnaire administration, the study analysed sample characteristics with a view to determine their adequacy and to validate the data obtained. Figure 1 presents the respondents' profile. Quantity surveyors comprised the majority of respondents, with an equal number of architects and engineers. The composition of project or construction manager further constituted 31 % of the total.

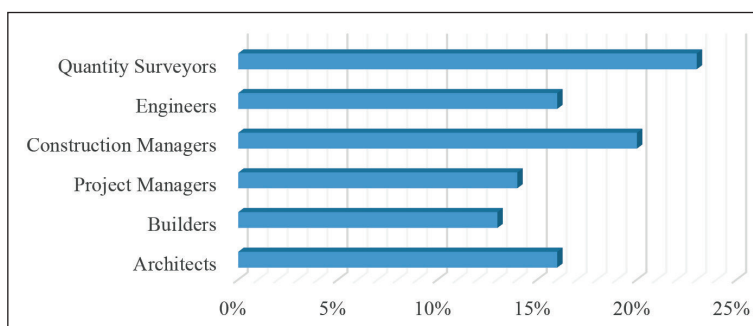


Figure 1: Profile of respondents

Table 1 shows the qualifications, experiences and positions of respondents. These variables were significant indicators of empowerment to embed change within an organisation. It was recalled that the resource dimension of structuration theory empowered organisational interactive relationships based on expertise, or social networks and contributed to the way the firm's elements take action. The level of empowerment to effect change in the organisations was, therefore, determined based on three variables, which were position in the organisation, level of education and other qualifications (Gumilar and Gablon, 2013).

The ratio of respondents with experience of 0-10 years and 10-20 years was 1:2 and three per cent of the total sample also had more than 20 years' experience in the industry. Qualification was assessed using two criteria, namely level of education and professional qualifications. Ninety per cent of the sample had degrees relevant to construction industry. Respondents with cogent construction degrees included 35 % M.Sc. and PhD and 84 % registered professionals. Middle management staff comprised the majority compared with their top and lower rung compatriots. When the population of middle management staff in the sample was rationalised to practices in the construction industry, their roles across organisations could be justified. Middle- and lower-management staff formed the majority in construction firms and most of them were saddled with the responsibility to implement decisions. The views of the respondents were, therefore, appropriate. The combined population of lower- and middle-management staff in the sample was 79 %.

In line with the prior theory of the study, this paper contended that the efficiency and effectiveness of SCP dissemination practices adapted in learning by middle managers were essential drivers needed to activate their actions to embed new knowledge. Therefore, as the respondents' professional qualifications, education and experience were synonymous with readiness to implement organisational change in adopting SCP (see prior theory), the sample characteristics were, therefore, adequate. Data obtained from the population of the study was also reliable to conclude the correlation between dissemination practices and organisational change to embed SCP.

#### *Reliability indices of the study's variables*

A total of 13 dissemination strategies and four processes for knowledge development in organisation were evaluated in the study environment. The results in Table 2 indicated that all practices were relevant strategies to disseminate SCP. The reliability test yielded Cronbach alpha values greater than the 0.70 benchmark adopted by this study. The views of the respondents about identified strategies and knowledge management processes constituting valid constructs of related variables were consistent and coherent.

#### *Effects of dissemination practices on organisational change to adopt sustainable construction practices*

This section determines the hypothesis which states that dissemination practices had no significant correlation with organisational

Table 1: Experience, qualifications and position in construction firms

Experience	Qualification		Position in Organisation					
Variables	N	%	1 <sup>st</sup> degree only	50	53	Top mgt.	20	21
0-10 years	60	63	M.Sc. and above	35	36	Middle mgt.	40	42
10-20 years	32	34	HND	10	11	Lower Mgt.	35	37
20 years and above	3	3	Registered	80	84	Total	95	100
Total	95	100	Not Registered	15	16			

Mgt. = Management; N = Number; % = Percentage



Table 2: Objectives, level of use and effectiveness of SCP dissemination strategies

Code	Strategies/Tools	A
AW1	Person-to-person interfacing	0.870
AW2	Cluster briefing	0.780
AW3	Web-based publishing	0.891
AW4	Emailing	0.706
UN1	Research publications	0.856
UN2	Scientific publications	0.835
UN3	Conferences	0.889
UN4	Workshops	0.900
UN5	Symposia	0.897
UN6	Exhibition fair	0.901
AC1	Integrated practice	0.923
AC2	Case studies	0.910
AC3	Exemplar projects	0.890
OAK1	Knowledge socialisation	0.789
OAK2	Knowledge internalisation	0.765
OAK3	Knowledge externalisation	0.802
OAK4	Knowledge combination	0.705

$\alpha$  = Cronbach alpha (reliability test); AW1-3; UN1-5 and AC1-3 are variables codes

changes to adopt SCP. The statistical tool involved canonical correlation analysis. The tool was adopted to determine the correlational effect of dissemination practices on knowledge dissemination processes as a correlation to organisational change to embed SCP. The test consisted of two components: Dependent (knowledge dissemination processes) and independent (dissemination practices). The independent component had thirteen variables, namely case study, integrated practice, exemplar projects, exhibition fair, symposia, workshops, conferences, scientific publications, research publications, emailing, web-based publishing, cluster briefing and person-to-person interfacing. Both components (dependent and independent) were measured using ordinal scale.

The analysis revealed that a combination of dissemination practices had varying degrees of effect on knowledge dissemination processes as a correlation of organisation readiness to embed SCP. The varying degrees of correlational effects were represented by a three-band correlation

co-efficient, namely very high, average and low. Knowledge dissemination processes were represented by the four canonical roots 1-4 as stated in Table 3. The canonical correlation co-efficient was very high for root 1 (knowledge socialisation) and root 2 (knowledge internalisation). The correlation co-efficient for root 3 (externalisation) was average while root 4 (knowledge combination) was low. These results indicated that the correlational effects of dissemination practices on SCP knowledge socialisation and internalisation in firms using validated dissemination practices were very high; the effect on knowledge externalisation was average and knowledge combination was low.

The Wilks' multivariate test was used to measure the significance of the correlation. The results in Table 3 further revealed that the Wilks' statistics for knowledge dissemination processes namely: socialisation, internalisation, externalisation and combination, were significant (0.059; 0.237; 0.755; 0.932 > 0.05).

The significance (p-value) of the Wilks values was also less than 0.05 for roots 1 to 4. The inference was that the indicative hypothesis of the study could be rejected for roots 1 to 4. The implication was dissemination practices could enhance knowledge socialisation, internalisation, externalisation and combination. Since the influence of dissemination practices on organisational knowledge dissemination process was significant for the four dimensions of dependent variables, the overall correlation effect between dissemination practices and organisational change to embed SCP was, therefore, significant.

The above model fitness was further supported by the Eigenvalue results. The Eigenvalue indicated the extent of variates of the canonical roots (Sherry and Hanson, 2005). It also measured the strength of the relationship between dependent and independent components. An Eigenvalue of one meant that the amount of variance equalled the quantity of variance explained by an average variable in the model (Warner, 2008). Therefore, the Eigenvalues for knowledge socialisation and internalisation were significant. The amount of variance explained by dissemination practices for socialisation and internalisation was greater than those accounted for by an average variable in the model. From the results in Table 3, the Eigenvalues for knowledge externalisation and combination were insignificant. The amount of variance explained by dissemination practices for socialisation and internalisation were less than accounted for by an average variable in model.

Table 3 shows that from the *F*-test results, the canonical relationships were statistically significant. The relative importance of each dissemination practice in the canonical function was further examined using the standardised canonical functions. Traditionally, the relative importance of each variable was determined by the sign and magnitude of the canonical variate.

Based on the results in Table 4, exhibition fair, scientific publication and cluster briefing had positive effect on knowledge socialisation, while exhibition fair emerged as the most significant dissemination practice for socialisation. Exhibition fair also emerged as the most significant dissemination practice with overall positive impact on knowledge internalisation. This was followed by workshops and case studies. Case studies emerged the most significant dissemination practice with the overall impact on knowledge externalisation, while exemplar project has the most significant influence on knowledge combination. In summary, cluster briefing, exhibition fair and case studies were the most important dissemination practices with overall positive impact on knowledge dissemination processes. The impact of cluster briefing was positive for all knowledge dissemination processes. Cluster briefing was also the most significant practice in terms of spread across knowledge dissemination protocols. Exhibition fair had the most positive impact on knowledge socialisation, internalisation and combination, while case studies showed positive correlation with knowledge internalisation and externalisation. The result of case studies situated it as the most important dissemination strategy for

Table 3: Correlational effect of dissemination practices on organisational change to adopt SCP (n = 135)

Roots	Correlation	Eigenvalue	Wilks Statistic	F	Num D.F.	Denom D.F.	p-value
1	.867	3.033	.059	29.185	48.000	1288.642	.000
2	.828	2.185	.237	18.862	33.000	987.676	.000
3	.436	.235	.755	5.074	20.000	672.000	.000
4	.260	.072	.932	2.713	9.000	337.000	.005

F = F-Ratio; 1 = knowledge socialisation; 2 = knowledge internalisation; 3 = knowledge externalisation; 4 = knowledge combination

Table 4: Standardised Canonical correlation co-efficient

Dissemination Practices	Knowledge Socialisation	Knowledge Internalisation	Knowledge Externalisation	Knowledge Combination
Person to Person	-.183	-.047	-.854	-.045
Cluster briefing	<b>.231</b>	.036	<b>.443</b>	<b>.876</b>
Web-publishing	.203	-.094	.411	.293
Research-publication	-.158	.018	.245	-.053
Other Scientific publication	<b>.441</b>	-.121	-.499	-.203
Conferences	-.112	.089	.015	<b>.376</b>
Workshops	.037	<b>.626</b>	.206	-.229
Symposia	-.287	.342	<b>.397</b>	.140
Exhibition fairs	<b>.544</b>	<b>.774</b>	-.462	.168
Integrated practice	-.055	.020	-.569	-.183
Case Studies	-.098	<b>.520</b>	<b>.787</b>	-.485
Exemplar Projects	-.375	.036	-.777	<b>.873</b>

achieving internalisation and externalisation in the dissemination of SCP at intra-organisational level, while exemplar project was the best practice for converting tacit knowledge to explicit knowledge (that is knowledge combination). The direct positive relationship suggested that organisational adaptation of SCP could be enhanced by strengthening and enforcing dissemination using these practices.

The above analysis evaluated the correlational effect of dissemination practices on organisational change to adopt SCP based on the extent to which knowledge dissemination processes were enhanced. The metrics used conformed to knowledge-based theory, where knowledge transfer to practice was conditioned on the extent of knowledge possessed by the firm's human capital. The established relationships portrayed that the deployment of varying dissemination practices had different impact on organisation integration of innovation. The results also buttressed the importance of interaction by human capital in knowledge development and integration within and organisation. The human capital within the organisation, therefore, required appropriate level of education and professionals' qualification in SCP knowledge to process and

disseminate related knowledge effectively to practice based on the proposition of the structuration theory.

The results also show that cluster of dissemination strategies were important and that no standalone strategy was objective enough to drive needed change in adopting SCP. This means that organisational change to adopt SCP must be implemented in stages using varying dissemination practices. Pertinent stages might begin with embedding awareness of SCP benefits, to embedding an understanding of applicable tools and practices towards real-life implementation. Each of these objectives required varying approaches to achieve their dissemination goals. This implied that to disseminate for implementation (adoption), SCP benefits, tools and practices must be effectively understood to empower the human capital in the firm to influence client's decision to adopt SCP.

The high correlational co-efficient depicted strong affinity between those dissemination practices and organisational change to adopt SCP. The varying significance of dissemination practices was, however, not unexpected. The results, therefore, suggested a combination of hybrid strategies could be more beneficial in

influencing organisational change to adopt SCP. The theoretical synthesis of the study concurred with an earlier study, which concluded that a combination of dissemination practices was directly related to the type of innovation disseminated (Sepasgozar *et al.*, 2018). Similarly, the results were also consistent with the findings of Bresnen *et al.* (2005), which reported that dissemination of management norms interacted in the quest to effect organisational change. The varying performance of dissemination practices was consistent and synonymous with varying needs of organisational elements to embed sustainable construction practices.

### Conclusion

The study showed that a combination of different dissemination strategies was directly related with knowledge internalisation, socialisation, externalisation and combination across the firm's structure. The conclusion was developed from the hypothesis that examined the correlation between dissemination practices and organisational change to adopt sustainable construction practices. The hypothesis was developed to address pedagogical issues affecting the learning of sustainable construction practices in the industry. This followed the assumption that due to the magnitude of skills dearth in the construction industry, learning within the sector had failed to steer commitment of stakeholders to adopt sustainable construction practices because key players were not properly informed. Although, the research community had responded variously as evidenced in the skeletal literatures in the research area, issues relating to the performance of knowledge dissemination practices continued to receive insignificant empirical validation.

This paper addressed this gap by focusing on the effect of dissemination practices on organisational change to embed SCP. Positive organisational change to adopt SCP was, therefore, best developed using exemplar projects, case studies and cluster briefing. Stakeholders are advised to focus on developing

real-life projects using SCP to facilitate deeper embedding of related knowledge across the built environment. The research result signals an important departure from the unbalanced interests on knowledge transfer performance rather than the transfer mechanisms. The study, therefore, bridges the gap in pedagogical issues affecting the learning of sustainable construction and associated knowledge transfer across domains.

### Acknowledgements

This paper is the preliminary findings of the research project which aims to develop a framework for embedding sustainable construction practices among construction organizations in Nigeria. The authors wish to appreciate the contributions of former chief editor of the journal, peer reviewers and Dr. Issac Odesola to improve this article.

### References

- Baker, R., Chang, C., Bunting, J., & Betit, E. (2015). Triage for action: systematic assessment and dissemination of construction health and safety research, *American Journal of Industrial Medicine*, 58, 838-848
- Barrela, E. & Watson, M. K. (2015). Comparing the outcomes of horizontal and vertical integration of sustainability content into engineering curricula using concept maps. *The 7<sup>th</sup> International Conference on Engineering Education for Sustainable Development*, Vancouver, Canada,
- Bejide, O. I. & Iyagba, R. A. (2015). Assessing the training needs of construction managers in Nigeria. *Proceeding of 2nd NIQS Research Conference*, Federal University of Technology Akure, 1-3rd September, p.p. 178 -188.
- Bresnen, M., Goussevskaia, A. & Swan, J. (2005). Implementing Change in Construction Project Organisations: Exploring the Interplay between Structure

- and Agency, *Building Research and Information*, 33(6), 547-560.
- Brick, J. M. & Tourangeau, R. (2017). Responsive survey designs for reducing nonresponse bias. *Journal of Official Statistics*, 33(3), 735-752
- Bywood, P., Terao, H., & Roche, A. (2008). *Effective Dissemination: an Examination of Theories and Models of Change for Research Dissemination in the AOD Field*. Adelaide: National Centre for Education and Training on Addiction.
- Chan, A. P.; Darko, A. & Ameyaw, E. E. (2017). Strategies for promoting green building technologies adoption in the construction industry -an international study, *Sustainability*, 9(969), 1-17
- Chindo, P. G., Ibrahim, A. D., Ibrahim, Y. M. & Musa-Haddary, Y. G. (2015). Assessing the Performance of Nigeria Trained Construction Craft Skills. In: Ogunsemi, D. R., Awodele, O. Oke, O. (Eds): *Confluence of Research, Theory and Practice in Quantity Surveying Profession for a Sustainable Built Environment*, Proceeding of the 2nd NIQS Research Conference, Akure, 1-3rd September, p.p. 317-331.
- Corry, N. H. Williams, C. S. Battaglia, M. McMasters, H. S. & Stander, V. A. (2017). Assessing and adjusting for non-response in the millennium cohort family study, *BMC Medical Research Methodology*, 17(16), 1-17.
- Dattalo, P. V. (2014). *A Demonstration of Canonical Correlation Analysis with Orthogonal Rotation to Facilitate Interpretation*, Social Works Publications, Virginia Commonwealth University, Richmond.
- Enshassi, A., Arain, F. & Tayeh, B. (2012). Major causes of problems between contractors and subcontractors in the Gaza Strip, *Journal of Financial Management of Property and Construction*, 17(1), 92-112.
- Eresia-Eke, C.E. & Makore, S. (2015). The relationship between knowledge dissemination and organisational performance in the construction industry, *Socioeconomica*, 4(8), 477-492.
- Fernie, S., Leiringer, R. & Thorpe, T. (2006). Rethinking change in construction: A critical perspective. *Building Research and Information*, 34(2), 91-103.
- Giddens, A. (1990). *The Consequences of Modernity*, Stanford University Press, Stanford, CA.
- Gelengis, J., & Harris, D. (2014). Undergraduate studies in energy education – A comparative study of Greek and British Courses, *Renewable Energy*, 62, 349-352.
- Gumilar, V. & Goblon, A. (2013). *Awareness, Dissemination, Networking and Training, Final Version of the Awareness and Dissemination Plan and Training Materials*.
- Gleeson, M. P. & Thomson, C. S. (2012). Investigating a Suitable Learning Environment to Advance Sustainable Practices among Micro Construction Enterprises. In: Smith, S.D (Ed) *Proceedings 28th Annual ARCOM Conference*, 3-5 September 2012, Edinburgh, UK, Association of Researchers in Construction Management, p.p.1245-1255.
- Gunnaway, D. & Hinton, T. (2011). A Review of the Dissemination Strategies Used by Projects Funded by the ALTC Grants Schemes, Retrieved from [www.tedi.uq.edu.au/dissemination](http://www.tedi.uq.edu.au/dissemination)
- Harmsworth, S., & Turpin, S. (2001). TQEF National Co-ordination Team, Pell, Godfrey, In: Rees, A. & Bridging the Gap *Creating and Effective Dissemination Strategy, An Expanded Interactive Workbook for Educational Development Projects*.
- Heffernan, E., Pan, W. & Liang, X. (2012). Delivering Zero Carbon Homes in the UK. In Smith, S. D. (Ed) *Proceedings 28th Annual ARCOM Conference*, 3-5 September 2012,

- Edinburgh, UK, Association of Researchers in Construction Management, p.p. 1445-1454.
- Higham, A. & Fortune, C. (2012). Investment Appraisal Tools and Sustainability Evaluation in Social Housing' *In: Smith, S.D (Ed) Proceedings 28th Annual ARCOM Conference, 3-5 September 2012, Edinburgh, UK, Association of Researchers in Construction Management, p.p. 1269-1278.*
- Holmes, J. & Savgard, J. (2008). *Dissemination and Implementation of Environmental Research including Guidelines for Best Practice, Report 5681.*
- Khalfan, M. A., Bouchlaghem, D., Anumba, C. & Carrillo, P. (2012). A framework for managing sustainability knowledge, The C-SAND Approach. *Paper presented to e-Sm@rt 2002, Salford, UK 19-21 November 2002.*
- Hwang, B., Zhu, L., Wang, Y. & Cheong, X. (2017). Green building construction projects in Singapore: cost premiums and cost performance. *Project Management Journal, 48(4), 67-79.*
- Kalatunga, K., Kulatunga, U., Amaratunga, D. & Haigh, R. (2011). Client's championing characteristics that promote construction innovation. *Construction Innovation, 11(4), 360-398.*
- Kelfve, S., Thorslund, M. & Lennartsson, C. (2013). Sampling and non-response bias on health- outcomes in surveys of the oldest old. *European Journal Ageing, 10, 237-245.*
- King, V. (2010). Evidencing impact of educational developments: The influence wheel and its use in a CETL context. *Journal of Further and Higher Education, 34(1), 35-46.*
- Kibert, C. J. (2013). *Sustainable Construction: Green Building Design and Delivery*. Third Edition. New Jersey: John Wiley and Sons.
- Marriot, S.; Palmer, C. & Lelliott, P. (2000). Disseminating Healthcare Information: Getting the Message Across, *Quality in Health Care, 9, 58-62.*
- Murray, P. E. (2009). Personal education for sustainable development: The way forward for sustainable construction, *Sustainability in the Built Environment, ARCOM Doctorial Workshop, University of Plymouth.*
- Mitchell, R. & Boyle, B. (2010). Knowledge creation measurement methods. *Knowledge Management, 14(1), 15.*
- Nduka, D. O. & Ogunsanmi, O. E. (2015). Stakeholders perception of factors determining the adoptability of green building practices in construction projects in Nigeria, *Journal of Environment and Earth Science, 5(2), p.p. 188-196.*
- Nonaka, I. & Takeuchi, H. 1995. *The Knowledge Creating Company: How Japanese Companies Create the Dynamics of Innovation?* Oxford University Press, New York.
- Oliveira, S. & O'Flynn, P. (2015). Towards an Understanding of Building Energy Management Education – Users' Expectations of a UK Distance Learning Course' *In: Raidén, A. B. and Aboagye-Nimo, E. (Eds) Proceedings 31st Annual ARCOM Conference, 7-9 September 2015, Lincoln, UK, Association of Researchers in Construction Management, p.p.979-988.*
- Quimpo, R. G. & Neufield, R. D. (2007). *Dissemination Plan: Environmental Strategies for Highway Construction.*
- Rabin, B. A., Brownson, R. C., Haire-Joshu, D., Kreuter, M. W. and Weaver, N. L. (2008). A glossary for dissemination and implementation research in health, *Journal of Public Health Management and Practices, 14(2), p.p. 117-123.*
- Rezgui, Y. and Ferneley, E. (2005). *Creating, Sustaining and Disseminating Knowledge*

- for Sustainable Construction: Tools, Methods and Architecture*, ESPRC, London.
- Senaratne, S.; Jin, X. and Balasuriya, K. (2017). Exploring the role of networks in disseminating construction project knowledge through case studies. *Engineering, Construction and Architectural Management*, 24(6), 1281-1293.
- Sepasgozar, S. M. E., Davis, S. R. & Loosemore, M. (2018). Dissemination practices of construction sites' technology vendor in technology exhibitions. *Journal of Management in Engineering*, 34(6), 04018038-1- 04018038-12.
- Southwell, D., Gannaway, D., Orrell, J., Chalmers, D., & Abraham, C. (2010). Strategies for effective dissemination of the outcomes of teaching and learning projects. *Journal of Higher Education Policy and Management*, 32(1), p.p. 55-67.
- Trushell, I. & Egware, O. (2015). Formal education and the practice of negotiation: Benefits for quantity surveyors. In: Raidén, A B & Aboagye-Nimo, E (Eds.) *Proceedings 31st Annual ARCOM Conference, 7-9 September 2015*, Lincoln, UK, Association of Researchers in Construction Management, p.p. 1001-1010.
- Warner, R. M. (2008). *Applied statistics*. Los Angeles, CA: Sage Publications.
- Welch, L. S., Russell, D., Weinstock, D., Betit, E. (2015). Best practices for health and safety technology transfer in construction. *American Journal of Industrial Medicine*, 58, 849-857.
- Yang, J. (2007). The impact of knowledge sharing on organizational learning and effectiveness. *Journal of Knowledge Management*, 11(2), 83-90.