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Mediating Role of Dynamic Capabilities on the Relationship between Intellectual Capital and Performance: A Hierarchical Component Model Perspective in PLS-SEM Path Modeling

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ABSTRACT

The strategy of accumulating valuable assets guided by the firm's intellectual right is often not enough to support a significant performance in a rapidly changing environment. Hence, in such an environment, superior performance relies upon the ability of a firm to integrate, build and reconfigure those resources, the process of which is termed as dynamic capabilities. Hence, the purpose of this study is to investigate the mediating role of dynamic capabilities on the relationship between intellectual capital and manufacturing firm performance in a turbulent business setting. The data was gathered from 124 manufacturing enterprises in Nigeria and analyzed using the Partial Least Squares Structural Equation Modeling (PLS-SEM). The analyzed data supported all the hypothesized relationships of the study. Hence, the study found that there is positive relationships between all the dimensions of intellectual capital and dynamic capabilities and also dynamic capabilities mediate the relationship between intellectual capital and performance. Consequently, this study concluded that managers need to deploy not only valuable resources but also dynamic capabilities by reconfiguring their existing resources to conceive of and implement difficult to replicate value adding strategies. Finally, the study outlined some limitations that opened the avenues for future research.

Key words: Intellectual capital, dynamic capabilities, hierarchical component modeling, small firms

INTRODUCTION

Strategy theories recognize the impact of the firm's knowledge assets as idiosyncratic and valuable sources of performance. Resources-based is one of those perspectives that theorized perfectly inimitable and immobile idiosyncratic knowledge assets as a source of firm performance (Barney, 1991). However, such firm's knowledge assets may be conceptualized as stocks and flows of knowledge, which significantly contribute to the firm superior performance (Decarolis and Deeds, 1999; Dierickx and Cool, 1989). According to Nieves *et al.* (2014), knowledge resources are the valuable assets that are confined from imitation through the creation of knowledge barriers. These assets are also subtle and usually very difficult to understand as they involve talents that are elusive, which connection with the results is hard to detect (Lippman and Rumelt, 1982; Miller and Shamsie, 1996). Such knowledge assets are invaded in individual staff minds (Stein and Zwass, 1995), organizational routines, processes and structures, as well as external relationships created between firms and external individuals, other companies and institutions (Nieves and Haller, 2014).

Roos and Roos (1997) argued that intellectual capital is the type of knowledge assets that passed Barney's (1991) rareness, inimitable and non-substitutable acid test of value-adding resources, which give a competitive advantage. Moreover, some empirical studies established that there is significant relationship between intellectual capital's dimensions and performance (Abdullah and Sofian, 2012; Chen *et al.*, 2014; Santos-Rodriues *et al.*, 2010; Lu *et al.*, 2014). Nevertheless, in rapidly changing environments, the strategy of accumulating valuable assets guided by the firm's intellectual right is often not enough to support a significant performance (Teece *et al.*, 1997). Thus, in such environments, superior performance relies on the firm's ability to integrate, build and reconfigure such intangible resources (Wu, 2007). This process of integrating and reconfiguring intangible firm's resources is what has been termed as dynamic capabilities (Teece and Pisano, 1994; Teece *et al.*, 1997) that have been theorized as integrative mechanisms between the firm's resources and superior performance.

Even though, there are some previous studies conducted on the impact of both knowledge resources and dynamic capabilities on performance, most of those studies solely focused on either the effect of knowledge or dynamic capabilities on performance and hence hitherto there are few studies that investigate the impact of knowledge assets on performance through the mechanisms of dynamic capabilities (Tseng and Lee, 2014). Consequently, this study drawn on resource-based view of the firm (Barney, 1991) and dynamic capabilities view (Teece *et al.*, 1997) to fill the aforementioned knowledge gap by examining the mediating effect of dynamic capabilities on the relationship between intellectual capital and manufacturing firm performance in the Nigerian context.

THEORIES AND HYPOTHESES

Resource-based and dynamic capabilities perspectives: One of the most popular theories conceptualized on the effects of heterogeneous intangible valuable firm resources to determine and sustain firm performance is Resource-Based View (RBV) of the firm (Barney, 1986, 1991; Bridoux, 2003). The RBV posits that if all firms within an industry share the same resources, none of them is having a possibility of sustained competitive advantage (Barney, 1991). This is because, if a firm is able to conceive of and implement strategies that can improve its performance, other firms can also do the same as they possessed everything in common. Thus, the source of performance is for a firm in an industry to control heterogeneous intangible valuable, rareness, inimitable and non-substitutable resources to be used in implementing strategy that is not simultaneously being implemented by rival firms and also difficult to be duplicated by current or potential competitors (Barney, 1991).

However, in spite of potentiality of RBV in explaining how a firm can use its intangible resources to conceive of and implement valuable strategy that sources performance, the approach lapsed in the explanation on how and why some firms outperform others in rapidly changing environments (Carlos, 2011; Eisenhardt and Martin, 2000). Thus, Dynamic Capabilities View (DCV) evolved as coordinative paradigm to complete and complement the RBV in determining the source of firm superior performance in such unpredicted and rapidly changing settings (Teece and Pisano, 1994; Teece *et al.*, 1997). On the other hand, resource-based approach expanded to dynamic capabilities view to address this concern (Carlos, 2011; Nieves and Haller, 2014).

Dynamic capabilities approach posits that successful firms are those that demonstrate response on time, rapid and flexible innovation along with the management capabilities to effectively coordinate and redeploy internal and external competences (Teece and Pisano, 1994; Teece *et al.*,

1997). As such, to be strategic, a particular capability must be honed to a user need, unique and difficult to replicate (Teece *et al.*, 1997). Unlike RBV, which built on the platform of heterogeneous and inimitable resources, DCV posits that the essence of competences and capabilities is rooted in the organizational and managerial processes shaped by the assets positions of a firm and molded by its paths. However, in spite of all the aforementioned arguments, it has been recognized that each of these theories complement one another in determining firm sustained competitive advantage and superior performance (Teece and Pisano, 1994; Teece *et al.*, 1997).

Intellectual capital: The concept of intellectual capital has grown and attained its popularity for the past few decades (Grantham *et al.*, 1996). This followed the recognition of the management of intellectual capital as one of the major tasks of firms' executive agenda (Martin-de-Castro *et al.*, 2006) due to the increased turbulence, changes and knowledge requirements that led to the rise in complexity of the internal and external firms' environment (Johannessen *et al.*, 2005). Hence, the term has been used in place of firms' intangible or knowledge assets (De Castro and Lopez-Saez, 2008; Rexhepi *et al.*, 2013). By definition, intellectual capital is a set of intangible knowledge assets that generates firm performance and value creation (Gogan and Draghici, 2013). It is intangible benefits accessed by a particular firm, which is generated by its workforce and the relationships it established with other groups including customers, suppliers as well as its competitors (Gowthorpe, 2009). However, this type of knowledge assets has been described as multidimensional construct comprising human, organizational or structural and relational capitals (De Castro and Lopez-Saez, 2008; Diez *et al.*, 2010; Gogan and Draghici, 2013; McConnachie, 1997; McPhail, 2009; Lu and Hung, 2010; Sydler *et al.*, 2014).

Human capital is one of the crucial form of knowledge assets that resides within individual employees (Nieves and Haller, 2014) and represents the information and knowledge stocks of a firm own by its employees, which are the sources of strategic innovation and invention (Yildiz *et al.*, 2014). This form of intellectual capital encompasses both explicit and tacit knowledge possessed by the firm's employees and their ability to generate such knowledge that could be used to achieve organizational mission (De Castro and Lopez-Saez, 2008). It comprises knowledge's stock of capital skills, attitudes and intellectual agility of employees at all levels and their ability to make good decisions, deal with the problems, as well as creating and maintaining good interpersonal relationships (Gogan and Draghici, 2013). Other elements of human capital includes experience, business knowledge, education, creativity (Yildiz *et al.*, 2014), teamwork capacity, competence, training, loyalty, motivation of employees (Sydler *et al.*, 2013), personal traits such as ability to learn, desire to share information, participating and commitment to overall firm's goals and objectives (Marcin, 2013).

Structural capital on the other hand, refers to the firm's investment in systems as well as tools and philosophy that affects the flow of knowledge processes (Gogan and Draghici, 2013) and remains with a firm even when employees leave as its generally explicit and owned by a firm independently from its employees (Sydler *et al.*, 2013). This form of intellectual capital represents the sum total of organizational capabilities that are considered to be owned by a business and enable it to meet its market requirements (Yildiz *et al.*, 2014). Structural capital includes both organizational and technological elements that pursue the integration and coordination of activities within a firm (De Castro and Lopez-Saez, 2008). These elements include intellectual property, culture, systems and processes (Yildiz *et al.*, 2014), databases and computer networks, equipment structure, management style or software as well organizational culture (Gogan and Draghici, 2013).

Lastly, relational capital gathers the value of that relationship that a firm acquires and maintains with external environmental agents (De Castro and Lopez-Saez, 2008; Gogan and Draghici, 2013). It is the information, which is grounded within the market channels, which a firm developed through business and customer relations (Yildiz *et al.*, 2014) and the entirety of the value of the relationships between a firm with people and organizations with which it conducts its business (Sydler *et al.*, 2014). These include the relationships of a firm with its clients and business partners (Gogan and Draghici, 2013), customer branding and customer satisfaction (Yildiz *et al.*, 2014), network with suppliers, external stakeholders, distributors and most importantly customer relationships such as image building and customer loyalty and branding such as preference, reputation, attitude and brand recognition (Sydler *et al.*, 2014).

Dynamic capabilities: The concept of dynamic capabilities was originated from the work of Schumpeter in 1934 (Camison and Monfort-Mir, 2012; Jiao *et al.*, 2013; Pavlou and Sawy, 2011). The Schumpeterian view hypothesized that the routines and capabilities that comprise the fundamental structure of a firm and the evolutionary that fit between environment and a firm are what determine performance (Makkonen *et al.*, 2014). Moreover, the view suggested that the novel combination of knowledge and the firm's existing resources into new operational capabilities constitutes the fundamental of dynamic capabilities (Jiao *et al.*, 2013; Makkonen *et al.*, 2014; Pavlou and Sawy, 2011). This concept later developed in the literature and consequently taken the attention of various researchers (Pavlou and Sawy, 2011). Some of the previous works on the development of dynamic capabilities include architectural innovation (Henderson and Clark, 1990), combinative capabilities (Kogut and Zander, 1992) and configuration competences (Henderson and Cockburn, 1994). However, the recent extension of these studies by Teece and Pisano (1994), as well as Teece *et al.* (1997) developed the precise notion of dynamic capabilities and their antecedents (Pavlou and Sawy, 2011). Hence, the dynamic capabilities framework by Teece (2007) and the previous conceptualization of the paradigm by Teece *et al.* (1997) perceived competitive advantage in turbulent and unpredicted settings as a function of dynamic capabilities. In this sense, the performance of a firm that operates in such an environment is subjected to its ability to renew and reconfigure its competences and existing capabilities to address environmental changes.

By definition, dynamic capabilities as according to Teece *et al.* (1997) refer to the ability of a firm to build, integrate and reconfigure its internal and external competences in order to address rapidly changing environments. These capabilities are the antecedents of firms' strategic routines by which managers integrate, build and recombine resources and competences in order to generate and sustain superior performance (Eisenhardt and Martin, 2000). They are also seen as learned and stable pattern of collective activity by which a firm systematically generates and modifies operating routines in order to improve its effectiveness (Winter, 2003; Zollo and Winter, 2002). As such, these capabilities are the drivers of the creation, evolution and reconfiguration of existing resources to provide new sources of performance.

However, various scholars attempt to delineate different but related processes or phases of dynamic capabilities (Nieves and Haller, 2014). Li and Liu (2014) categorized dynamic capabilities into three dimensions namely strategic sense-making capacity, timely decision-making capacity, as well as change implementation capacity. On the other hand, Villar *et al.* (2014) proposed two dimensions of knowledge management dynamic capabilities, known as external knowledge integration and internal knowledge development. Similarly, Tseng and Lee (2014) employed two dimensions of sensing and integrating capabilities. Moreover, Denford (2013) classified dynamic

capabilities into creating, integrating, reconfiguring, replicating, developing, assimilating, synthesizing and imitating. However, the more comprehensive categorization that suited the need for this study is the one by Pavlou and Sawy (2011), who developed dynamic capabilities model that comprises four basic phases or dimensions (i.e., sensing, learning, integrating and coordinating). These dimensions comprise a pool of capabilities and their interaction in a logical sequence in reconfiguring existing firm's knowledge assets to address firms' environmental changes (Nieves and Haller, 2014). According to Pavlou and Sawy (2011), the conceptualization of their dynamic capabilities model was fundamentally based on the work of Teece *et al.* (1997) on organizational and managerial processes roles (i.e., coordination/integration, learning and reconfiguration) and Teece (2007) framework (i.e., sensing environment to seize opportunities). Therefore, these set of capabilities best suited the need of knowledge assets reconfiguration in order to address a turbulent environment in order to generate and sustain superior performance. As such, the present study adopted this model.

Teece *et al.* (1997) noted that, the ability of a firm to integrate and build requirements for change and make necessary adjustment largely depends on its capacity to scan its business's environment, evaluate markets and competitors and accomplish reconfiguration quickly ahead of competition. As, reconfiguration requires a surveillance of new technologies and the market trend to sense and seize environmental opportunities (Pavlou and Sawy, 2011), therefore, the first dynamic capabilities phase is sensing. Sensing capability is the firm's ability to spot, interpret and pursue environmental opportunities (Nieves and Haller, 2014; Pavlou and Sawy, 2011). In the second phase, once opportunity has been identified by a firm, then it must address it with new products, services and processes that require decisions to revamp and renew existing firm's capabilities with learning new knowledge and skills (Pavlou and Sawy, 2011; Teece, 2007). Thus, the second phase of dynamic capabilities is learning capability, which refers to the firm's ability to revamp its existing operational capabilities with new knowledge (Nieves and Haller, 2014). Pavlou and Sawy (2011) also argued that learning capability is related to the firm's ability to obtain new knowledge, as well as transforming and exploiting that knowledge.

Thirdly, as the new knowledge created through learning is mostly owned by individuals, therefore, such knowledge must be integrated into a collective level in order to have supra-individual knowledge. Pavlou and Sawy (2011) argued that since, reconfiguration relies on the firm's integration of new knowledge resources and assets, a collective logic and shared interaction patterns are required thereby integrating such individual's new acquired knowledge to the firm's collective knowledge. Hence, the integrating capability concerns with the ability of a firm to combine knowledge of different individuals into the firm's new operational capabilities (Nieves and Haller, 2014). Finally, as new operational capabilities' reconfiguration require effective coordination of resources, tasks and synchronization of activities, thus, the coordinating capability administers resources, task and activities to deploy the reconfigured operational capabilities (Pavlou and Sawy, 2011). Hence, coordinating capability concerns with the ability of a firm to coordinate and deploy its tasks, resources and activities in the new operational capabilities (Nieves and Haller, 2014; Pavlou and Sawy, 2011). However, Pavlou and Sawy (2011) noted that, coordinating capability's basic routines include assigning resources to a task, appointing a right person to a right job, identifying complementarities and synergies among tasks and resources, as well as orchestrating collective activities.

Intellectual capital and dynamic capabilities: In today's business environment, which is characterized by phenomena such as globalization, e-business hyper-competitiveness, fast

technological innovations, as well as rapid changes in economic and political structures, firms need to develop and define clear strategies that will give rise to capabilities, competences and sustained competitive advantage (Marr *et al.*, 2004). Tseng and Lee (2014) argued that the firm's ability to effectively apply its knowledge resources to develop an idiosyncratic dynamic capabilities that can quickly response to the environmental changes has become an urgent need due to the incapability of the current conventional strategic management model to deal with various questions about organizational management. Roos and Roos (1997) considered intellectual capital as a form of knowledge asset, which is the most significant source of organizational routines and the firm's production processes as well as core competences and capabilities that generate performance. Stahle and Hong (2002) stated that the concept of intellectual capital was created for updating understanding of the competitive edge of firms in rapidly changing environments. However, Pemberton and Stonehouse (2000) argued that the competitive success of a firm is subject to its ability to integrate these knowledge assets that can create core competences. Similarly, it has been suggested that the novel combination of existing knowledge assets and firm resources into new operational capabilities constitutes the fundamental of dynamic capabilities (Jiao *et al.*, 2013; Makkonen *et al.*, 2014; Pavlou and Sawy, 2011). Consequently, the present study proposed the following hypotheses:

- **H1:** Human capital has a positive relationship with dynamic capabilities
- **H2:** Structural capital has a positive relationship with dynamic capabilities
- **H3:** Relational capital has a positive relationship with dynamic capabilities

Mediating effect of dynamic capabilities: Dynamic capabilities paradigm is a potentially integrative model of understanding new sources of performance thereby enabling the reconfiguration of firm resources and competences to address environmental changes (Teece *et al.*, 1997; Wu, 2010). Dynamic capabilities, therefore, represent the high-level activities that enable firms' management to sense and seize opportunities and navigate threats thereby combining and reconfiguring firm assets to address changing customer needs and to sustain and strengthen evolutionary fitness, which results in long-run performance (Teece, 2007). However, Teece *et al.* (1997) posit that the essence of competences and capabilities is rooted in the organizational and managerial processes shaped by the assets positions such as the firm's difficult-to-trade knowledge assets, intellectual property, relational assets and technological assets. Similarly, Nickerson and Silverman (1997) argued that the integration of intellectual capital strategy is a key competitive weapon for business performance.

More so, various scholars theorized that such rareness, inimitable and non-substitutable resources could be reconfigured to implement value-adding strategy that has not been simultaneously implemented by rival firms and also difficult to be replicated (Barney, 1986; Dierickx and Cool, 1989; Wenerfelt, 1984), which in return determine superior performance (Barney, 1991). Consequently, some studies previously conducted to prove this analogy empirically by investigating how dynamic capabilities mediate the relationship between valuable resource-based and performance (Lin and Wu, 2014), entrepreneurial resources and start-up performance (Wu, 2007), as well as firm resources and IT enterprises performance (Wu, 2006). As such, the present study hypothesized that dynamic capabilities significantly mediate the relationship between intellectual capital dimensions and superior performance in rapidly changing business environments. The hypotheses are presented as follows:

- **H4:** Dynamic capabilities mediate the relationship between human capital and performance
- **H2:** Dynamic capabilities mediate the relationship between structural capital and performance
- **H3:** Dynamic capabilities mediate the relationship between relational capital and performance

MATERIALS AND METHODS

Design and sample: This research was designed as a quantitative study, which engaged in hypotheses testing of the causal relationship between predictors and criterion variables, which is commonly known as causal research (Sekaran and Bougie, 2013). Generally, organizational researchers drawing on quantitative research often employ survey method as it is considered the most appropriate for collecting information on predetermined instruments that yield statistical data on a large sample for the purpose of generalizing the result (Creswell, 2003). The current study also adopted the cross-sectional method to gather data over a single period of time. The structured questionnaire was designed to collect the relevant data using the self-administered method. At the end of the data collection, 124 instruments duly responded by managers were found usable for the analysis of this study. Hence, structural equation modeling was employed for both measurement analysis and hypotheses testing using PLS-SEM path modeling.

Measurement: However, to measure the latent variables of this study, some previously developed and used measures were adapted from the previous literature. For the dependent variable (i.e., firm performance) eight items were adapted from the work of Spillan and Parnell (2006). On the other hand, the concept of dynamic capabilities was measured using existing model developed by Pavlou and Sawy (2011). This construct is operationalized as a reflective-formative type of Hierarchical Component Model (HCM) consisting of four Lower Order Components (LOCs), such as sensing, learning, integrating and coordinating capabilities. However, nineteen indicators (i.e., four for the first dimension and five for each of three others) were adapted from the Pavlou and Sawy (2011) study. Finally, the three dimensions of intellectual capital (i.e., human, structural and relational) were measured using twelve items adapted from the work of De Castro and Lopez-Saez (2008). In this case, the first four items represent human capital, three for structural capital and last five for relational capital respectively. Seven-point Likert-type scale (ranging from 1 = strongly disagree to 7 = strongly agree) was also used for all constructs.

RESULTS

Measurement model: The reliability and validity of the model were assessed by the measurement model of PLS-SEM path modeling. As can be seen from Table 1, the reliability analysis has been achieved for all reflective constructs as represented by Composite Reliability (CR), which is above the threshold of 0.70 for all variables. The Average Variance Extracted (AVE) that represents the convergent validity of reflective constructs is also achieved. As shown in Table 1, the grand mean scores of each construct (i.e., the average of the squared of factor loadings of each construct's items) is above the threshold of 0.50 and thus indicates that each of these constructs explains more than 50% of the variance of its indicators (Hair *et al.*, 2014). On the other hand, to ascertain the discriminant validity of the reflective constructs, the square root of AVE of each variable should be higher than its correlations with any other construct (Fornell and Larcker, 1981). As shown in Table 2, the diagonal bolded values represent the square root of AVE, which is above the correlation of any reflective variable with one another. This clearly indicates the distinctiveness of each of these constructs.

Table 1: Measurement information: convergent validity (n = 124)

Constructs	Items	Loadings	AVE	CR
Human capital	HC01	0.798	0.616	0.864
	HC02	0.799		
	HC03	0.849		
	HC04	0.684		
Structural capital	SC01	0.881	0.662	0.854
	SC02	0.814		
	SC03	0.740		
Relational capital	RC02	0.765	0.600	0.818
	RC04	0.759		
	RC05	0.799		
Performance	FP01	0.765	0.669	0.934
	FP02	0.879		
	FP03	0.861		
	FP04	0.812		
	FP05	0.810		
	FP06	0.835		
	FP07	0.757		
	FP08	0.757		

RC01, RC03 and FP07 were deleted due to measurement issues, CR: Composite reliability, AVE: Average variance extracted

Table 2: Measurement information: discriminant validity (n = 124)

Constructs	1	2	3	4	5
Human capital	0.785*				
Structural capital	0.721	0.814*			
Relational capital	0.810	0.782	0.774*		
Performance	0.646	0.651	0.653	0.818*	
Dynamic capabilities	0.707	0.692	0.730	0.924	Formative

*Diagonal values correspond to the square root of the AVE of the reflective constructs. For the formative construct (dynamic capabilities) CR, AVE and the square root of AVE not applicable. Sample size: 124

Table 3: Variance inflation factor and formative indicators significance testing results (n = 124)

Formative constructs	Formative indicators	VIF	Outer weights	Outer loadings	T statistics
Dynamics capabilities	Coordinating capability	3.520	0.402	0.929	5.748***
	Integrating capability	2.970	0.211	0.862	3.613***
	Learning capability	4.056	0.277	0.922	3.043***
	Sensing capability	3.685	0.212	0.895	2.944***

***p<0.01; **p<0.05; *p<0.1, the values in parentheses (i.e., outer loadings) represent absolute contribution or importance, whereas, their corresponding values by the left (i.e., outer weights) represent the relative contribution or importance of that same indicator to the main construct (i.e., dynamic capabilities), VIF: Variance inflation factor

However, to assess the formative model (i.e., dynamic capabilities) of this study, there are two conditions to examine each indicator for it to enter into the main construct (Hair *et al.*, 2014). The first condition is to assess the collinearity among the indicators with Variance Inflation Factor (VIF) values, the threshold of which is less than 5. The second is to evaluate the significance of statistical contribution (i.e., both relatively and absolutely contribution) of each indicator to the main construct. Nevertheless, before assessing these conditions, as the construct is a reflective-formative type of Hierarchical Component Model (HCM), the repeated indicator approach was first employed thereby repeating the indicators of Lower Order Components (LOCs), i.e., learning, sensing, integrating and coordinating capabilities on the Higher Order Component (HOC) i.e., dynamic capabilities so as to obtain the latent variable scores of LOCs (Afthanorhan, 2014; Becker *et al.*, 2012; Ringle *et al.*, 2012). Subsequently, these latent variable scores used for the two-stage approach, thereby using each LOC's scores as a formative indicator for HOC (Hair *et al.*, 2014).

As can be shown in Table 3, the VIF values of all indicators of the formative construct (i.e., dynamic capabilities) are below the critical value of 5. This clearly indicates that no multicollinearity exists among the indicators. On the other hand, the outer weights values of all

Table 4: Structural analysis result (n = 124)

Hypotheses	Relationships	Beta	SE	t-value	Decision
H1	Human capital->Dynamic capabilities	0.271	0.109	2.484***	Supported
H2	Structural capital->Dynamic capabilities	0.251	0.082	3.070***	Supported
H3	Relational capital->Dynamic capabilities	0.315	0.119	2.649***	Supported
H4	Human capital->DCs->Performance	0.251	0.096	2.615***	Supported
H5	Structural capital->DCs->Performance	0.231	0.079	2.909***	Supported
H6	Relational capital->DCs->Performance	0.291	0.105	2.771***	Supported

***p < 0.01, Hypotheses 1-3: IV-MV relationships, Hypotheses 4-6: Mediating relationships, SE: Standard error

Table 5: Bootstrapped confidence interval

Hypotheses	Path A	Path B	Indirect effects	SE	t-value	95% LL	95% UL
H4	0.271	0.924	0.251	0.096	2.615	0.062	0.439
H5	0.251	0.924	0.231	0.079	2.909	0.076	0.387
H6	0.315	0.924	0.291	0.105	2.771	0.085	0.497

Hypothesis is supported, when there is no zero between lower and upper limits, LL: Lower limit, UL: Upper limit, SE: Standard error

the formative indicators show an evidence of relative contributions to the main construct, as the values are all different from zero. Consequently, the analysis revealed that these indicators are relatively important to the construct. Similarly, the outer loadings as shown in Table 3 indicate an absolute contribution or importance of all formative indicators to the construct as their respective values are all above the threshold of 0.50. Unlike the outer weights values that are based on the indicator contribution in relation to the other indicator on the same construct, the outer loadings refer to an information provided by an indicator without considering any other indicator (Hair *et al.*, 2014).

Structural model: In order to analyze the predetermine hypotheses, the structural equation model was employed using bootstrap indirect effect (Hair *et al.*, 2014). As presented in Table 4, the statistical analysis revealed that human capital is significantly related to dynamic capabilities ($\beta = 0.271$, $p < 0.01$) and therefore hypotheses 1 is supported. Similarly, the empirical data indicated that structural capital is positively related to dynamic capabilities ($\beta = 0.251$, $p < 0.01$). Hence, the empirical analysis also supported the H2. More so, the analysis also supported H3 as relational capital is positively related to dynamic capabilities ($\beta = 0.315$, $p < 0.01$). On other hand, dynamic capabilities mediated the relationship between human capital and performance ($\beta = 0.251$, $p < 0.01$), structural capital and performance ($\beta = 0.231$, $p < 0.01$) and relational capital and performance ($\beta = 0.291$, $p < 0.10$). Thus, H4, H5 and H6 are all supported. To sum, the hypothesized direct relationships as H1, H2 and H3 are thereby supported empirically. On the mediating relationships, although all the mediation relationships are significant based on path coefficients (Beta) and their T-statistics (t-value), nevertheless, the hypotheses may only be supported when there is no zero between Lower Limit (LL) and Upper Limit (UL) of the confidence interval, which relies on bootstrapping standard error (Hair *et al.*, 2014). However, as shown in Table 5, there is no zero (i.e., when the lower limit has a negative and the upper bound has a positive signs) between any of the confidence intervals of each of the relationships. Hence, all hypothesized relationships on the mediating effect of dynamic capabilities on the relationship between independent variables (i.e., human, structural and relational capitals) and performance are therefore supported empirically.

DISCUSSION

This study investigated the impact of human, structural and relational capitals on dynamic capabilities, as well as mediating effects of dynamic capabilities on the relationship between these

predictors and manufacturing firms' performance in Nigeria. The study was built on the platform of resource-based (Barney, 1991) and dynamic capabilities perspectives (Teece *et al.*, 1997).

However, the statistical analysis of this study established the empirical evidence on the effects of human, relational and structural capitals on the development of dynamic capabilities and more importantly the mediating effect of dynamic capabilities on the relationship between the aforesaid intangible resources and performance. However, the results are not surprised compared to the previous studies as they also found that dynamic capabilities mediated the relationship between firm knowledge management practice and export performance (Villar *et al.*, 2014), valuable resource-based and performance (Lin and Wu, 2014), as well as entrepreneurial orientation and performance (Wu, 2007). As such, the study addressed an important knowledge gap of understanding how the intellectual capital form of knowledge resources could be used as an antecedent of dynamic capabilities and how this path relationship leads to the performance as well. At the same time, the study also reaffirmed the intervening role of the dynamic capabilities perspective between resource-based and performance.

CONCLUSION

In conclusion, this study concluded that the relationship between intellectual capital and performance is not direct in turbulent business environments but rather through the intervening role of dynamic capabilities. Consequently, in such turbulent business settings, firms need to deploy not only valuable knowledge assets but also dynamic capabilities for reconfiguring such resources in such a way that is so difficult to be understood and replicated by both current and potential competitors. On the other hand, one of the major limitations of this study is that it took into account of only intellectual capital, thereby neglecting other forms of knowledge resources. Hence, future study should include all other types of knowledge assets and other valuable resources, which were previously found to be significantly related to performance. In essence, the future research should be able to establish how those resources could determine performance through dynamic capabilities in the long-run. Secondly, the study included only formal manufacturing firms in Nigeria, thus, future study may consider other different sectors as well as smaller firms as they contribute more to the national economy and also comprise the large majority of businesses, especially in some developing countries.

Appendix A: Adapted measures of the study

Items	Questions
Human capital	
HC01	Our employees are among the most experienced in the industry
HC02	Our employees are creative and bright
HC03	Our employees are experts in their particular jobs and functions
HC04	Our employees develop new ideas and knowledge
Structural capital	
SC01 _a	Our efforts in creating and sustaining an organizational culture are among the highest in our industry
SC02 _a	We develop more ideas and services than any other firm in our industry
SC03 _a	We perform a lot of actions to spread our corporate values and beliefs
Relational capital	
*RC01	We devote an important part of our firm's budget for funding community development services
RC02	Our customers are highly loyal to our firm
*RC03	Our collaboration agreements are held during long periods of time
RC04	Our relations with suppliers are consistent and punctual
RC05	Our firm is recognized by external agents (customers, suppliers, competitors, and the general public) as one of the best firms in the industry

Appendix A: Continue

Items	Questions
Sensing capability	
SC01	We frequently scan the environment to identify new business opportunities
SC02	We periodically review the likely effect of changes in our business environment on customers
SC03	We often review our products and services development efforts to ensure they are in line with what customers want
SC04	We spend a great deal of time implementing ideas for new products and services and improving our existing product or services
Learning capability	
LC01	We have effective routines to identify the value, and import new information and knowledge
LC02	We have appropriate routines to assimilate new information and knowledge
LC03	We are effective in transforming existing information into new knowledge
LC04	We are effective in utilizing knowledge in new product or services
LC05	We are effective in developing new knowledge that has the potential to influence products or services development
Integrating capability	
IC01	Our employees' individual contributions are channeled through their work group
IC02	Members of our firm have a global understanding of each other's tasks and responsibilities
IC03	We are fully aware of who in the firm has specialized skills and knowledge relevant to our work
IC04	We carefully inter-relate actions between members of our firm to face changing conditions
IC05	Members of our firm manage to successfully interconnect their activities
Coordinating capability	
CC01	We ensure that the output of each employee's work is synchronized with that of the rest of the group
CC02	We ensure appropriate allocation of resources (e.g., information, time, reports)
CC03	Our employees are assigned to tasks commensurate with their relevant knowledge and skills
CC04	We ensure that employees' expertise is compatible with the work processes they are assigned to
CC05	Overall, our employees are well coordinated
Firm performance	
FP01	Profit goals have been achieved
FP02	Sales goals have been achieved
FP03	Returns on investment goals have been achieved
FP04	Our service(s) have a higher quality than those of our competitors
FP05	We have a higher customer retention rate than our competitors
FP06	We have a better reputation among major customer segments than our competitors
*PF07	We have a lower employee turnover rate than that of our competitors
FP07	We have been more effective in new product/service development than our competitors

Note: Any item/question marked * has been deleted from the model for measurement issues, _aUsed to distinguished structural capital from sensing capability items, as both used SC

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