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# The Effects of Knowledge Integration and Contextual Ambidexterity on Innovation in Entrepreneurial Ventures

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## Abstract

This paper utilizes insights from the knowledge-based view and ambidexterity literature to examine the effects of knowledge integration (KI) on innovation via contextual ambidexterity (CA). The paper also investigates the potential moderating role of human resource (HR) slack on the relationship between KI and CA. Using survey data collected from 245 entrepreneurial firms operating in Ghana, the findings show that KI positively relates to CA, and this relationship is moderated by HR slack. In addition, we observed that CA mediates KI and innovation. The broader theoretical and practical implications of the study are outlined.

**Keywords:** Africa; *knowledge integration; contextual ambidexterity; human resource slack; innovation; entrepreneurial firms; Ghana*

## **1. Introduction**

Today's hypercompetitive global environment demands that businesses innovate in a proactive manner in terms of their processes, products and services (Singh, Akbani & Dhir, 2020) to enhance their survival chances (Amankwah-Amoah & Wang, 2019; Amankwah-Amoah, Khan & Wood, 2020). Accordingly, the innovation literature has examined the influences of knowledge resources and mechanisms in firms' innovation process (Salunke, Weerawardena & McColl-Kennedy, 2019; Windler et al., 2017; Singh et al., 2020; Moreira, Kuk, Guimaraes & Albuquerque, 2020; Senbeto & Hon, 2020) and concluded that knowledge resources are crucial for innovations (Kraaijenbrink, 2012; Zhou & Li, 2012). In the past, firms tended to exclusively rely on their resources and expertise to innovate, nevertheless, this has now been superseded by a new approach that places greater emphasis on collaboration (Chesbrough, 2003; Chesbrough & Appleyard, 2007). Many entrepreneurial firms' new approach to innovation emphasizes collaboration, mobilization and utilization of cutting-edge market knowledge to inform strategic decisions (Chesbrough & Appleyard, 2007; Scuotto, Del Giudice, Bresciani & Meissner, 2017; Revilla et al., 2016). Moreover, entrepreneurial firms tend to integrate various sources of knowledge to complement inter-functional coordination, thereby effectively ensuring alignment goals to the structures, routines and processes.

The innovation literature suggests that a key differentiator between leading and lagging firms in achieving superior performance is their ability to concomitantly acquire and integrate knowledge into the processes of the firm (Grant, 2015; Lichtenthaler & Lichtenthaler, 2009; Scuotto et al., 2017). Indeed, firms' competitiveness and effective strategic alignment with changing customers' demand are increasingly predicated on their ability to mobilize and harness existing knowledge to innovate (Agostini, Nosella & Filippini, 2017). Collaborating with other firms provides an effective means of acquiring expertise, resources and knowledge for innovation activities (Chesbrough & Appleyard, 2007; Revilla, Rodriguez-Prado & Cui, 2016).

By effectively accumulating and leveraging new market knowledge, entrepreneurial firms can be better equipped to sense environmental upheavals to make changes to strategic decisions. Generally, the literature suggests that the alignment of goals to different functional units in innovation typically enhances the use of knowledge integration (KI) mechanisms due to the greater information processing demands involved (Germain & Dröge, 1997; Kumar & Seth, 1998). The integrating knowledge into the organizational process and decision-making also paves the way for firms to increase the chance of arriving at a high-quality solution, thereby enhancing their innovation performance (Tsai & Hsu, 2014).

Given that knowledge is omnipresent in firms' ability to innovate and adapt to changing circumstances (Sung & Choi, 2018), the mediating mechanism of CA could drive innovation for market competitiveness (Kotsemir & Meissner, 2013). The lack of attention is surprising given that KI enhances the competitiveness of entrepreneurial firms (Scuotto et al., 2017). In addition, despite these previous attempts at illuminating the KI-innovation linkage, the mechanisms through which KI relates to innovation remains poorly understood. By innovation, we refer to the introduction of new approaches to the firm that allows to bring new products or services to market (Burgelman & Sayles, 1988; Singh, Akbani & Dhir, 2020; Jaaron & Backhouse, 2018). This type of innovation can be new to the firm, industry or even the region at which the firm is operating.

While the outcomes of past investigations reinforce the critical importance of KI in innovation activities of entrepreneurial firms (Malerba & McKelvey, 2018; Malecki, 2011; Knockaert et al., 2011), there are still grey areas in terms of the mediating mechanism of the KI-innovation relationship in developing countries' entrepreneurial firms. Specifically, researchers have paid limited attention to how contextual ambidexterity (CA) mediates the relationship between KI and innovations. Defined as "the routines and processes used by organizations to mobilize, coordinate, and integrate dispersed exploratory and exploitative efforts and to allocate, reallocate, combine, and recombine resources and assets", CA has emerged as a key capability in competing across markets (Meglio, King & Risberg, 2015, p. 32-33, Al-Atwi et al., 2019; Agostini

et al., 2017). Whilst previous studies have examined the role of KI in ambidexterity (Filippini, Güttel & Nosella, 2012; Lin et al., 2017), the boundary limits of this nuanced relationship are still less under-researched. Against this backdrop, the purpose of this paper is to examine the KI-innovation relationship by testing the mediating role of contextual ambidexterity.

This paper contributes to the literature in several respects. First, although the innovation literature has taken several approaches to examine the role of KI on innovation in entrepreneurial firms (Malerba & McKelvey, 2018; Malecki, 2011; Knockaert et al., 2011), our understanding of how CA mediates this relationship is far from complete. By testing a model specifying that CA mediates the KI-innovation relationship, this paper extends the current CA literature (Carmeli & Halevi, 2009; Meglio et al., 2015; Wang & Rafiq, 2014) by enhancing our understanding of the mechanisms through which KI influences innovation in entrepreneurial ventures. Second, we integrate the knowledge-based literature (Grant, 1996; Nickerson & Zenger, 2004) and CA research (Meglio et al., 2015; Carmeli & Halevi, 2009) to examine how KI influences CA and the conditions. By testing the moderating impact of HR slack on the KI-CA nexus, we broaden the current knowledge on when KI effectively influences CA in entrepreneurial firms. This is an important extension of the literature given the lack of studies elucidating the boundary conditions of this nexus.

Third, we deviate from much of the current innovation literature to fill an important void in the African context. There is an under-researched area on exploration and exploitation, and innovation activities within an African context (Asaah, Yunfei, Wadei & Nkrumah, 2020). In such a developing country context, the experience of prior business ownership supplies entrepreneurs with the necessary knowledge to enable them to introduce innovations into the market (Robson et al., 2012). We extend this literature by demonstrating how KI leads to innovation in institutional context where the “rules of the game” are often uncertain or weak in their enforcements (Adomako et al., 2020). This contribution is critical given that previous studies suggest that major innovation activities are increasingly undertaken in developed economies (Luo, Sun & Wang, 2011) and most

entrepreneurial firms in emerging economies lack innovation capabilities resulting in “capability failure” (Lee 2013).

The rest of the paper proceeds as follows. We first present a review of literature on knowledge-based view and contextual ambidexterity followed by our hypothesis development. We then present the research method and key findings deduced from the data. The final section set out the theoretical and practical implications.

## **2. Theoretical background and hypotheses**

### *2.1 The knowledge-based view*

The knowledge-based view (KBV) (Grant, 1996; Martin & Javalgi, 2019; Nickerson & Zenger, 2004) suggests that competitiveness of a business can be traced to the knowledge it possesses, leverages and utilizes to outperform ally and rival firms. By focusing on knowledge as a source of variation in superior firm performance (Grant, 2002; Felin & Hesterly, 2007; Kearns & Sabherwal, 2006), the KBV considers firms’ capabilities as the outcome of the unique processes by which firms combine knowledge and resources they possess to create value for their customers (Martin & Javalgi, 2019). Knowledge-based resources may include employees’ know-how, capacity to learn and utilize knowledge for a successful innovation process (Jackson, DeNisi & Hitt, 2003). Past studies have demonstrated that knowledge tends to be context-specific (Sabherwal & Becerra-Fernandez, 2005) given that it stems from specific prior experiences, observations, research, and an encounter with the current firm’s monitoring processes. Thus, internally developed knowledge from prior experience (Leonard & Sensiper, 1998) and externally acquired knowledge from other firms through mechanisms such as acquisition and licensing intellectual property rights (Revilla et al., 2016) and personnel poaching (Amankwah-Amoah, 2020) are considered important sources of firm success. Thus, through knowledge accumulation, firms are better able to navigate the uncertain business environment (Beijerse, 1999) which allows them in their decision-making process (Cabrera-Suárez et al., 2001). Arguably, the importance of knowledge accumulation for

entrepreneurial firms is anchored in their ability to acquire and utilize specific knowledge reservoirs to improve their market competitiveness (Cabrera-Suárez, De Saá-Pérez & García-Almeida, 2001).

## *2.2 Contextual ambidexterity*

Since March's (1991) seminal paper, research on exploration activities (search, experimentation, and discovery) and exploitation activities (refinement and execution) has surged across all the management sub-disciplines (Raisch & Birkinshaw, 2008; Revilla et al., 2016). Particularly, there has been a concurrent pursuit of both activities (contextual ambidexterity) as the source of firm market competitiveness (Luo, Kumar, Mallick & Luo, 2019). Ambidexterity focuses on both the exploration and exploitation activities of firms (Raisch & Birkinshaw, 2008; Revilla et al., 2016). Although achieving the balance exploration and exploitation activities in innovation is a challenging task, it can enhance firm long-term survival and market competitiveness (Atuahene-Gima, 2005; McGrath, 2001; Wang & Rafiq, 2014). The conventional ambidexterity literature considers exploration and exploitation as competing activities (Duncan, 1976). To achieve a balance between these competing but vital activities, entrepreneurial firms must create structural or temporal separation between the two (Gupta, Smith & Shalley, 2006; Simsek et al., 2009). Yet, recent research indicates that CA (i.e., the concurrent exploration and exploitation within a business unit) is critical for firm success (Gibson & Birkinshaw, 2004; Wang & Rafiq, 2014).

In particular, exploratory activities of firms often deviate from current "knowledge and meet the needs of emerging customers or markets" with distinctive offerings (Luo et al., 2019, p. 614). It has been suggested that conceptual ambidexterity is embedded in the organizational culture that promotes creativity and discipline (Jelinek & Schoonhoven, 1993). As such, knowledge plays an important role to develop CA in entrepreneurial firms. By building on organizations' current knowledge and strengthening the processes, routines, and structures to address new demands, exploitation activities enrich the core competencies required for marked

competitiveness (Luo et al., 2019). More importantly, the literature on CA tends to integrate both exploration and exploitation with a single business unit but recognizes their differences in pursuit of organizational goals (Wang & Rafiq, 2014).

Based on the foregoing discussion, this paper argues that KI can influence CA because KI may promote creativity in entrepreneurial firms. The literature suggests diverse individual knowledge, skills, and abilities that promote creativity (Rink & Ellemers, 2007). As has been suggested in the ambidexterity literature, CA requires different knowledge and the integration of different perspectives for coherent decision-making (Eisenhardt & Schoonhoven, 1990). The ability to simultaneously pursue both exploration and exploitation yields stronger innovation performance (Wang & Rafiq, 2014). Therefore, a mechanism is required through which KI may lead to innovation. In addition, we contend that the effect of KI on CA may depend on HR slack since ambidexterity is a knowledge-intensive activity. HR slack is best deployed when the firm embraces growth-oriented activities (Mishina, Pollock & Porac 2004).

### *2.3 KI and CA*

KI focuses on organizations' ability and capacity to instill practices and processes that allow knowledge across functional areas of the business and outside the firm to be harnessed to improve their functioning of the business (Wouters & Roijmans, 2011). KI encompasses harnessing and utilizing both internal and external sources of knowledge to inform organizational decisions, which then could positively effect on performance (Haas, 2006). Firms can acquire external knowledge via inter-organizational personnel mobility (Amankwah-Amoah, 2020), inter-firm collaboration, and acquisition (Park, Mezias, Lee & Han, 2014). Some past studies suggest that the organizational utility of external knowledge is predicated on the existence of existing/complimentary knowledge and managerial expertise, i.e. effective alignment between the external and internal knowledge (Cassiman & Veugelers, 2006; Park, Mezias, Lee & Han, 2014). External knowledge-seeking can enrich firms' reservoir of knowledge to undertake project development activities (Park et al., 2014). KI also entails creating organizational level processes



with individuals that allow knowledge to flow across the structures of the firm. By absorbing and utilizing knowledge, organization enhances their ability to concurrently pursue the exploration and exploitation activities (Al-Atwi et al., 2019; Raisch, Birkinshaw, Probst & Tushman, 2009; Greve, 2007), which then enhance their operating capabilities.

In addition, past studies have demonstrated KI as a crucial organizational capability that can be harnessed to enhance new product development efforts (Roller, Eck & Dalakakis, 2004) and improve overall firm market competitiveness. Such cross-functional cooperation stemming from KI efforts are effective in mobilizing and connecting disjointed ideas across the organization (Wouters & Roijmans, 2011), thus, equipping it to innovate by capitalizing on the collaborative efforts. Given that innovation activities encompassed assessing current processes and routines, and problem-solving orientations (Wouters & Roijmans, 2011), KI is likely to boost new venture firms' exploration activities (search, experimentation and discovery) and exploitation activities. Hence:

**H1:** KI is positively related to CA.

#### *2.4 The mediating role of CA*

One of the key objectives of this paper was to examine the mediating role of CA in the KI-innovation nexus. The literature on KI suggests that the accumulation and integration of knowledge resources are critical for innovation activities (Menon & Pfeffer, 2003; Moorman & Miner, 1997). However, how CA mediates this link is not well understood. This paper suggests that CA is a mediator of the KI-innovation nexus for the following reasons. First, knowledge resources drive both exploration and exploitation which are required for innovation. Through CA, KI generates performance outcomes which are consistent with the resource-based perspective of the firm (Barney, 1991). A major rationale is that firm-level capabilities help firms to reconfigure, build, and deploy resources for exploration and exploitation activities within the firm (Amit & Schoemaker, 1993; Zhang et al., 2019).

Second, given that KI is the firm-level capability (Cepeda & Vera, 2007), it can help generate competitive strategy by transforming the firm's knowledge resources and operation routines to simultaneously pursue CA required to firm innovation activities (Eisenhardt & Martin, 2000). Third, the knowledge-based view suggests that KI and application are important to firm capabilities for firm performance (Nonaka, 1994; Taylor & Greve, 2006). This helps to build knowledge reservoirs to capture external and internal knowledge flows (Salunke et al., 2019) for exploring new competences and exploiting existing competencies (Gibson & Birkinshaw, 2004) for innovation. Arguably, for the firm to balance its exploration and exploitation activities, the key role of KI in the firm's innovation process is required to ensure that the required new knowledge combinations are made available to managerial decision-making. Taking to together, this paper proposes that:

**H2a:** CA mediates the relationship between KI and the number of innovations adopted by new ventures.

**H2b:** CA mediates the relationship between KI and the extent to which innovations are radical rather than incremental.

### *2.5 The moderating role of HR slack*

A core function of strategic HR focuses on developing firms' capacity and workers' skills and abilities to make an effective contribution to the firm's success (Amankwah-Amoah, 2020). HR slack resource denotes the under-utilized workforce that can be tapped to meet future demands or operational requirements (Kim, Shin, Shin & Park, 2019). The KBV suggests that knowledge is grounded in employees that is difficult for other firms to replicate (Mahoney & Kor, 2015). Unlike governments in industrialized economies, those in developing economies including many in Africa often offer limited or no incentives to firms to train their workers culminating in under-investment in skill formation activities (Debrah & Ofori, 2006). Given this limited incentive and unwillingness by firms to invest in training, many organizations are likely to have underutilized workers. However, both exploration and exploitation activities impose demands on firms to utilize their limited resources as such slack resources can provide the buffer to adapt to changes in the

business environment (Luo et al., 2019). HR slack provides the opportunity and space to experiment with new ideas and there creating conditions for the development of new knowledge. The firm's ability to act quickly to explore new opportunities is critical so is the exploitation of existing opportunities. However, firms with greater financial slack but limited HR slack will be less able to rapidly pursue exploration and exploitation activities. This may negatively impact on the KI-CA nexus compared to firms with HR slack. A major rationale is that firms with HR slack may be able to use the reservoir of knowledge acquired from keeping excess skilled employees to pursue more new opportunities, and exploiting existing ones more quickly, as they do not face HR constraints. In addition, given CA to be a resource-consuming activity, firms with greater HR slack can tap knowledge and skills required for CA. Thus, firms with greater HR base can leverage their resources for CA activities compared to firms with less HR slack. Particularly, in an entrepreneurial context, knowledge accruing from HRs could be tapped for exploration and exploitation activities. In the main, a firm's stock of employees helps in generating the required knowledge for exploration and exploitation activities as new employees would need time to learn and contribute to the firm's tacit knowledge (Levin & Cross, 2004). Collectively, holding HR slack appears to be the best way to meet unexpected demands in the exploration and exploitation activities of entrepreneurial firms. Based on this reasoning, this paper suggests that:

**H3:** HR slack moderates the relationship between KI and CA, such that the relationship is stronger when HR slack is greater.

### 3. Research method

#### *3.1 Sample and data collection*

To test our hypotheses, we collected data from entrepreneurial ventures operating in Ghana, as an emerging economy offers a fertile ground for investigating this issue (Amankwah-Amoah, Boso & Antwi-Agyei, 2018). Respondents were entrepreneurs/founders who have participated in the start-up process of their businesses. Initially, 206 entrepreneurs were discovered by students who contacted entrepreneurs for an assignment in entrepreneurship. In addition, we randomly selected

394 entrepreneurs' names and addresses from the Ghana Business Directory (<https://www.ghanayello.com/>). We sent invitation letters explaining our intention to survey entrepreneurs on their firm innovation for a research project. Before the questionnaires were sent out for the main survey, we conducted a face-to-face interview (each interview lasting for 35-50 minutes) with six entrepreneurs located in Accra. This was done to ensure that the items included in the survey booklet were correctly interpreted by respondents.

We then mailed a total of 600 surveys, followed by self-addressed and stamped returned envelopes, and received 199 complete surveys. Of the 193 surveys, 6 were discarded due to missing values. Thus, 193 useable surveys were obtained in the first round. We sent two rounds of reminders in March and April 2019 respectively, generating another 52 responses. Our final sample size was 245, representing a 40.08 % response rate. We checked for non-response bias by comparing available firm characteristics from the Ghana Business Directory, including firm age, firm size, and industry with our data. The results revealed no bias in the sample. The entrepreneurs in our sample were operating mainly in the service (76.19%) and manufacturing (23.81%) sectors. Among the 245 entrepreneurs, 70% were males; and 30% were females. The average previous experience was 5 years. The average firm size was 5 full-time employees and had operated for 2 years since incorporated. The average sales revenues for 2019 was \$400,469.20.

### 3.2 Measures

*Knowledge integration.* We measured KI with five items ( $\alpha=0.93$ ) from De Luca, Verona & Vicari, (2010). These items capture the extent to which the firms use a set of formal integration mechanisms to integrate scientific and market knowledge. The items were measured on a seven-point scale with anchors ranging from 1=strongly disagree to 7=strongly agree. The variable score for KI was calculated by taking the combined mean of the five items of the KI scale.

*Contextual ambidexterity.* We adopted the measures of competence exploration ( $\alpha=0.91$ ) and exploitation ( $\alpha=0.88$ ) from Atuahene-Gima (2005) and were measured on a seven-point Likert scale (1=strongly disagree; 7=strongly agree). To arrive at the overall score for CA, we followed

He Wong (2004) in using the aggregate dimension of exploration and exploitation (i.e., combination) as a proxy of contextual ambidexterity.

*Human resource slack.* We followed precedence and captured HR slack as the number of employees (in FTE) relative to sales (Voss, Sirdeshmukh & Voss, 2008). We then adjusted the measure by subtracting the median ratio of employment to sales for all firms in the same sub-industry in which the firm in question operates (Mellahi & Wilkinson 2010).

*Innovation.* Previous studies have measured innovation through new product introductions (Katila, 2002). Our measure of innovation refers to firm-level product innovation and was measured with indicators of product introductions. First, entrepreneurs as respondents were asked to report the number of new products or services their firms have introduced in the past 3 years. This item was used to collect data on the number of innovations created by new ventures. Previous research has found this measure of innovation to be robust in many research settings (Baron & Tang, 2011; Smith, Collins & Clark, 2005). Second, we measured the radicalness of innovations (the extent to which the innovations make the firm's current products or services lines obsolete) with three items ( $\alpha=0.96$ ) from Subramaniam and Youndt (2005). We asked respondents to rate how radical each of the innovations was on a seven-point Likert scale (1=strongly disagree; 7=strongly agree). The three items were averaged to obtain the score for radical innovations

*Control variables.* Several variables were used as control variables. At the individual level, an entrepreneur's age, gender, and previous experience were controlled because they have been found to influence firm innovation (Reynolds, 2000). The age of the entrepreneur was measured as the number of years of the entrepreneur/founder. Gender was coded as 1=female and 0=male. Previous experience was captured with three items that asked respondents to report the number of years of previous entrepreneurial, managerial, and industrial experiences they have had before founding the current business (Baron & Tang, 2011) ( $\alpha =0.95$ ). As with all multi-item scales in the study, the combined mean of the scale measures constitutes the variable score for previous experience. Given that firm size, firm age, industry, and sales revenues influence

innovation (Baron & Tang, 2009), we controlled for these firm-level variables. Firm size was measured as the number of full-time employees in each firm as of 2019. Firm age was captured as the number of years since the firm was incepted. The industry was measured as a dummy variable (0=service; 1=manufacturing). Sales revenues were measured by asking entrepreneurs to report the sales revenues of the year 2018. We used the natural log for sales revenues to account for skewed distribution within the data.

### *3.3 Discriminant validity*

Before hypothesis testing, we examined the discriminant validity of our variables. Though KI, CA, and innovation are theoretically different constructs, we performed confirmatory analysis (CFA) using the structural equation modeling software LISREL 8.71. To empirically evaluate discriminant validity, we calculated the square root of the average variance extracted (AVE) for each of the variables. Various models were experimented from including five factors (five variables) to one-factor (five factors combined into one variable). We examined the model fit of each and tested chi-square differences to establish which model provided a better fit to the data. Table 1 shows that the full-factor model fits the data very well (Thompson, 2004). Additionally, in the full-factor model, all the items significantly loaded on their respective latent variables. To test the discriminant validity of our measures, we calculated the square roots of the AVEs for all multi-item constructs. The results in Table 2 indicated that discriminant validity applies particularly to our core constructs of KI (square root of AVE: 0.81), exploration (square root of AVE: 0.80), exploitation (square root of AVE: 0.82), and radicalness of innovation (square root of AVE: 0.91), which correlate at 0.48, suggesting satisfactory discriminant validity for our measures (Fornell & Larcker, 1981).

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**Insert Table 1 about here**  
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### *3.4 Concerns for common method variance*

Given that our data come from a single source, there is a potential concern for common method variance caused by a common source (Podsakoff et al., 2003). As such we undertook several procedural steps to address the common method issue: (1) we conducted a pilot study to establish whether the items are subject to ambiguity, (2) we promised to protect respondent anonymity, (3) the items for the dependent, mediating and independent variables were not located close to each other in the survey. This was done to attenuate the incentive to use previous responses to answer subsequent questions.

In addition, we utilized statistical methods to address common method variance. First, adopted Harman's one-factor test (Podsakoff et al., 2003) and load all the variables into an exploratory factor analysis (EFA) with principal axis factoring and varimax rotation. This returned five factors with eigenvalues  $>1.0$  and 67.21% of the variance explained. No single factor was dominant, and the largest component accounted for 19.17% of the variance. with the first factor accounting for 17.64% of the variance. Second, we used the approach suggested by Lindell and Whitney (2001) to test for common method variance. Accordingly, we identified a marker item that is not conceptually related to any of the constructs in our model. An item that measures optimism was identified as a variable not conceptually related to any of our constructs (i.e., "I am always optimistic about my future"). Results demonstrate that correlation between the marker variable item and radical innovation is not significant ( $r = -0.04$ ;  $p > 0.10$ ). We found similar results for the correlations between the marker variable items and the number of innovations ( $r = -0.03$ ;  $p > 0.10$ ). Additionally, we found low and nonsignificant correlations between the marker variable item and other constructs (i.e., ranging between 0.00 and 0.05. Collectively, results from the above analyses indicate that no common method variance was detected in this study.

#### 4. Results

Table 2 presents the means, standard deviations, and correlation for the study variables. The correlations in Table 2 indicate that KI is positively associated with CA, and CA is positively

associated with both the number of innovations and the radicalness of these innovations. The variables were standardized to prevent multicollinearity (Aiken & West, 1991). The largest variable inflation factor (VIF) in the full models was 3.38, which is way below the suggested threshold value of 10 (Neter, et al., 1996). This suggests that multicollinearity did not pose a serious problem in our analysis. Hypotheses were tested using hierarchical regression analysis.

Table 3 presents the results of the hierarchical regression. The dependent variable in Models 1-4 is CA. Model 1 tests the effects of the control variables. Model 2 added KI and it has a significant effect on CA ( $\beta= 0.23, p< 0.01$ ). This observation provides support for H1. When HR slack was included in Model 3, the influence of KI on CA remains significant ( $\beta= 0.22, p< 0.01$ ). In Model 4, we included the interaction terms for KI and HR slack. The interaction term is positive and significant ( $\beta= 0.56, p< 0.01$ ). This finding suggests that HR slack positively moderates the relationship between KI and CA. This finding provides support for H3.

To explain the nature of the significant interactions, the effect of KI on CA was plotted at high and low levels of HR slack (Aiken & West, 1991). Figure 1 suggests that the effect of KI on CA is more positive among firms with greater HR slack than among firms with lower HR slack.

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**Insert Table 2 about here**  
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The dependent variable in Models 5-7 is the number of innovations whiles Models 8-10 have radicalness of innovation as a dependent variable. Given that the dependent variable in Models 5-7 is a count variable, we followed established practice (Baron & Tang, 2011) in using count hierarchical regression. The results in Models 5-10 test the mediating hypotheses. The mediating hypotheses were tested using the approach suggested by Zhao, Lynch and Chen (2010). First, the



independent variable and the mediating variable should be significantly related. As shown in Model 2, the relationship between KI and CA (mediator) was positively related ( $\beta= 0.23, p< 0.01$ ). Second, the mediating variable and the dependent variable should be significantly related to each other. The results in Model 5 contain the influence of the control on number of innovations. Model 6 introduces the effect of the moderator (human resource slack). The results in Model 8 test the influence of the control variables on radicalness of innovation. The results in Model 7 and Model 10 suggest that CA is positively related to both the number of innovations ( $\beta= 0.26, p< 0.01$ ) and radicalness of these innovations ( $\beta= 0.29, p< 0.01$ ). Third, the relationship between the independent variable and the dependent variable should be non-significant when the mediating variable is added to the regression equation. In Model 7 and Model 10, when both KI and CA are included in the regression equation, CA has a positive influence on both the number of innovations ( $\beta= 0.27, p< 0.01$ ) and the radicalness of innovations ( $\beta= 0.29, p< 0.01$ ). In addition, the effect of KI on both the number of innovations ( $\beta= 0.03, ns$ ) and radicalness of innovations ( $\beta= 0.04, ns$ ) becomes nonsignificant. These results suggest that CA mediates KI and the number of innovations, and radicalness of these innovations. Thus, H2a and H2b are supported.

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**Insert Table 4a about here**  
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To gain additional insights into the mediation analysis, we performed a PROCESS analysis using the approach suggested by (Hayes, 2013). This analysis was conducted to establish the mediation effect when the moderating effect of HR slack is added. Tables 4a and 4b present the conditional indirect effects of CA at different values of HR slack. The results of the PROCESS analysis show that the indirect effect of knowledge integration via contextual ambidexterity was conditional on

the level of human resource slack. In Table 4a, the results show that the indirect effect was stronger (Conditional indirect effect=0.09) and significant at high levels of human resource slack (CI ranging from 0.05 to 0.14, not crossing zero) for number of innovations but was weaker (Conditional indirect effect=0.01) and nonsignificant at a low level of human resource slack (CI ranging from -0.02 to 0.03). Besides, in Table 4b the results show that the indirect effect of knowledge integration on radicalness of innovation via contextual ambidexterity was conditional on a high level of human resource slack. The indirect effect was significant at high level of human resource slack (Conditional indirect effect=0.10; CI ranging from 0.08 to 0.19, not crossing zero) and nonsignificant at a low level of financial resource slack (Conditional indirect effect=0.02; CI ranging from -0.01 to 0.05, crossing zero). These findings support H2.

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**Insert Figure 1 about here**  
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#### *4.1 Supplementary analyses*

We undertook additional analyses to substantiate the robustness of our model. First, we used alternative measures of innovation as our dependent variable. Specifically, we used the three-item scale developed by Naman and Slevin (1993) to measure innovation. The results confirmed findings reported above for all the hypotheses relating to innovation as a dependent variable. Second, we re-estimated our model with firm employment growth as a dependent variable. We used employment growth data (2016–2018) gathered from finance managers of the firms in our sample (N = 119) to retest our hypotheses. Finance managers were asked in the survey to record the level of employment growth in their firms during 2016–2018. Utilizing the same analytical approach, we found that CA mediates the relationship between KI and employment growth. Third, we tested an alternative model by adding additional control variables including environmental dynamism and environmental munificence. Substantially, the results were in line with our initial findings. This indicates that the results presented in this paper are robust to alternative explanations (Stam, 2010).

## 5. Discussion and implications

Building on the knowledge-based view (Grant, 1996) and prior studies (De Luca, Verona & Vicari, 2010; Zahra et al., 2000), this paper explored how KI influences innovation in new ventures through the mechanism of CA. Specifically, the first finding (i.e., KI positively relates to CA) indicates the importance of the neglecting impact of KI in new ventures' CA. By integrating insights from research suggesting that exploration and exploitation relationship is intrinsically linked to the capability–rigidity paradox in innovation (Leonard-Barton, 1992), that the findings suggest that insights derived from KI are a valuable resource for exploring and exploiting opportunities (Boxenbaum & Rouleau, 2011). We also found that CA mediates the relationship between KI and innovation. Besides, the role of HR slack was found to moderate the relationship between KI and CA in H3. Given that HR slack facilitates growth strategies based on its prior knowledge (Lecuona & Reitzig, 2014), it provides better leverage to increase employees' *knowledge*, a resource that is not liquid and that is bound to context to focus exploitation and exploration. Therefore, a higher level of HR slack could help new ventures to identify and exploit opportunities simultaneously through KI by holding HR slack.

### 5.1 Theoretical contributions

This study extends the literature in three main ways. First, our paper contributes to the innovation literature (Adomako et al., 2019) by exploring the mediating mechanism of the relationship between KI and innovation. While previous studies have revealed the importance of KI in innovation and entrepreneurship (De Luca & Atuahene-Gima, 2007; Koch, 2011; Zahra, Nielsen & Bogner, 1999), they leave the actual question of the mediating mechanism through which KI relates to innovation for future researchers to address. Thus, we build on these studies to provide an understanding of the mediating mechanism of the link between KI and innovation. Second, the findings enhance our understanding of the role that KI plays in facilitating exploration and exploitation activities in new ventures. Specifically, our study complements existing studies (Simsek et al., 2009; Wang & Rafiq, 2014; Wu & Wu, 2016) by suggesting that KI could help new

firms manage the competing tensions of achieving ambidexterity. Therefore, our paper provides a more comprehensive understanding of the role of KI in managing exploration and exploitation activities in new ventures.

Third, this paper addresses the fundamental question of when KI effectively drives CA. In doing so, we advance our understanding of the boundary conditions of the impact of KI. Though the role of KI has been extensively investigated (Tsai, Liao & Hsu, 2015; Zahra et al., 1999), our understanding of when it is more or less effective in driving CA remains limited. Thus, this paper empirically investigates the boundary conditions of the impact of KI on CA. Taken together, this paper contributes by providing a clearer illustration of the mediating mechanism of the relationship between KI and innovation.

## *5.2 Practical implications*

Besides the theoretical contributions, our paper offers some practical implications. First, entrepreneurs of new ventures could leverage their KI activities to manage the exploration and exploitation tensions. The findings suggest the need for entrepreneurial firms in developing countries to integrate knowledge into ventures' exploration and exploitation activities. Second, the findings that KI has different impacts on CA depending on HR slack suggests that KI may not always lead to improved CA when a firm's level of HR slack is low. This suggests that owners of new ventures would be well- advised to pay particular attention to hiring business excess employees when leveraging on knowledge to increase exploration and exploitation activities. Thus, entrepreneurs need to hold more HR slack than they require to manage exploration and exploitation tensions. Third, the finding that KI indirectly influences innovation through CA is particularly important for entrepreneurs in general. This suggests that entrepreneurial managers should not be only aware of the importance of KI but also CA in the link between KI and innovation. It is therefore crucial for managers to facilitate the dynamics of KI and CA by taking a leading role in managing KI and CA processes in new ventures to yield innovation success. For

example, firms can amplify and enlarge knowledge through the dynamic conversion between tacit and explicit knowledge. Thus, entrepreneurial managers should nurture an enabling environment that allows employees to share and exchange tacit knowledge to create new knowledge in entrepreneurial firms.

This paper suggests that KI is important for innovation through CA a developing country because managers require to invest a great deal of time and energy on emotionally laden aims since the institutional frameworks that support innovation are weaker within developing countries. In other words, our analysis suggests that innovation activities can lead to sustained growth in emerging economies such as ones in sub-Saharan Africa where firms tend to experience short-lived growth due to lack of global product competitiveness (Cimoli et al., 2009).

## **6. Limitations and future research**

In spite of the contributions, our study has some important limitations that provide fruitful avenues for future research. The recommendations for future research have been divided into three distinct but related trajectories, namely: theory, contexts, and methodology.

### *6.1. Future directions – theory*

First, we encourage future research to extend our findings beyond the developing country contexts. For example, future research could replicate this research model in emerging economies such as India, China, and Brazil. It will be interesting to explore how KI drives innovation through CA in these economies. Second, our study goes further than other studies by examining the mediating role of CA in the relationship between KI and innovation. However, we did not consider the roles played by organizational routines, cultures and other knowledge management processes such as knowledge creation process and knowledge accumulation. We encourage future research to examine the role of knowledge creation processes in innovation management. Moreover, future studies might gain additional insights by exploring other potential mediators such as organizational factors, other knowledge management processes, or the change of manager.

### *6.2. Future directions – contexts*

Contextually, we drew our sample from new ventures in the manufacturing and services sectors and controlled for firm size, it would be interesting to investigate how KI influences CA in large and mature firms which are considered more resourceful than new ventures. For example, future studies could compare the results in large organizations such as multinationals operating in developing market economies. Moreover, developing countries tend to share some common characteristics such as institutional weakness compared to developed country settings (Adomako et al., 2020). However, there might be some contextual differences within developing countries. Although our study used data from Ghana, a growing entrepreneurial market in Africa, these findings might not be universally applicable to all developing country contexts. We therefore encourage future research to be devoted to a larger and more varied sample of entrepreneurial firms from both developed and developing countries.

### *6.3. Future directions – methodology*

In this study, the self-reported and same source nature of our data could raise potential common method bias concerns. Thus, future research may make use of multiple respondents to capture the independent and dependent variables. For example, future research could collect data on the dependent variable using top managers (e.g., finance, HR, marketing, technology, and operations managers). Moreover, our paper could not collect data with a one-year time-lag between the dependent and independent variables. Besides our failure to manipulate variables or use randomly assigned techniques prevented us from making causal claims. Future research could address this limitation by adopting an experimental design or longitudinal approach with a three-year time-lag between the collection of data on the dependent and independent variables. Finally, as with survey-based research, the results from this study may be influenced by survival bias because it was not possible to collect data on firms that were no longer in operation.

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Table 1. Results of confirmatory factor analysis

	$\chi^2/df$	CFI	NNFI	RMSEA	SRMR
Recommended values	$\leq 3$	$\geq 0.9$	$\geq 0.9$	$\leq 0.08$	$\leq 0.08$
Full model CFA	1.34***	0.96	0.96	0.05	0.06
One factor model CFA	2.45***	0.67	0.66	0.09	0.14

\*\*\* $p < 0.01$ . CFI=comparative fit index; NNFI=non-normed fit index; RMSEA=root mean square error of approximation; SRMR= standard root mean-square residual

**Table 2: Descriptive statistics and correlations (square root of AVE in the diagonal)**

	Variables	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13
1.	Firm size (employees)	5.25	1.52	--												
2.	Firm age (years)	3.54	0.80	-0.05	--											
3.	Industry	0.76	0.42	0.09	-0.04	--										
4.	Sales revenues <sup>a</sup>	5.84	1.58	0.11	-0.09	0.18**	--									
5.	Entrepreneur's age	48.14	9.47	0.04	0.05	0.07	0.00	--								
6.	Gender	0.73	0.42	0.11	0.00	0.01	0.04	0.01	--							
7.	Previous experience	4.58	1.85	0.09	0.07	0.12	0.19**	0.27**	0.04	<b>(0.83)</b>						
8.	Knowledge integration	4.02	1.35	0.15*	0.07	-0.05	0.25**	0.19*	0.03	0.28**	<b>(0.81)</b>					
9.	Human resource slack <sup>b</sup>	14.22	21.87	0.16*	0.11	-0.08	0.10	0.19**	0.05	0.20**	0.30**	--				
10.	Exploration	4.81	1.13	-0.05	-0.09	0.17**	0.12	0.11	0.07	0.14*	0.30**	0.15*	<b>(0.80)</b>			
11.	Exploitation	4.58	.84	0.02	0.05	0.15	0.11	0.07	0.05	0.12	0.21**	0.12	0.24**	<b>(0.82)</b>		
12.	# of innovations	1.42	1.89	0.15*	-0.11	0.27**	0.15*	0.13*	0.09	0.27**	0.19**	0.39**	0.35**	0.11	--	
13.	Radicalness of innovations	4.55	1.11	0.14*	-0.15*	0.23**	0.12	0.09	-0.19**	0.13*	0.22**	0.25**	0.26**	0.43**	0.29**	<b>(0.91)</b>

\*p < 0.05; \*\*p < 0.01 (2-tailed test); S.D. = Standard Deviation. <sup>a</sup> Natural logarithm. <sup>b</sup> The mean value for this construct can be interpreted as a percentage

**Table 3: Regression Results**

	<b>Models 1–4: Contextual Ambidexterity</b>				<b>Models 5–7: Number of innovations</b>			<b>Model 8-10: Radicalness of Innovation</b>		
<i>Control variables</i>	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Firm size (employees)	-0.03	-0.04	-0.04	-0.04	0.11	0.04	0.04	0.06	0.05	0.05
Firm age	-0.05	-0.05	-0.05	-0.05	-0.03	-0.03	-0.03	-0.09	-0.09	-0.08
Industry dummy	0.17**	0.17**	0.18**	0.17**	0.20**	0.21**	0.22**	0.20**	0.20**	0.18**
Sales revenues <sup>a</sup>	0.14*	0.13	0.14*	0.14**	0.11	0.11	0.11	0.13	0.12	0.10
Entrepreneur's age	0.06	0.06	0.06	0.07	0.08	0.08	0.09	0.06	0.06	0.04
Gender	0.08	0.08	0.09	0.09	0.05	0.05	0.06	-0.18**	-0.19**	-0.16**
Previous experience	0.14*	0.14*	0.14*	0.14*	0.23**	0.24**	0.24**	0.14	0.12	0.11
<i>Independent variable</i>										
Knowledge integration (KI)		0.23**	0.22**	0.14*		0.26**	0.03		0.25**	0.04
<i>Moderator</i>										
Human resource slack (HRS) <sup>b</sup>			0.14*	0.12		0.28**	0.28**		0.28**	0.29**
<i>Interaction</i>										
KI * HRS				0.56**						
<i>Mediator</i>										
Contextual ambidexterity							0.27**			0.29**
<i>Model fit statistics</i>										
F	1.59	3.78**	5.10**	9.16**	3.23**	4.19**	5.71**	3.18**	4.96**	5.67**
R <sup>2</sup>	0.11	0.16	0.21	0.29	0.13	0.18	0.24	0.14	0.18	0.23
ΔR <sup>2</sup>	-	0.05	0.05	0.08	-	0.05	0.06	-	0.04	0.05
Largest VIF	1.11	2.56	3.19	3.38	1.09	1.64	3.16	1.99	1.07	2.08

N = 245; \*\*  $p < 0.01$ , \*  $p < 0.05$ .; standardized coefficients are shown. <sup>a</sup> Logarithm transformation of original values. <sup>b</sup> The mean value for this construct can be interpreted as a percentage.

**Table 4a. Moderated mediation results for number of innovations across levels of financial slack**

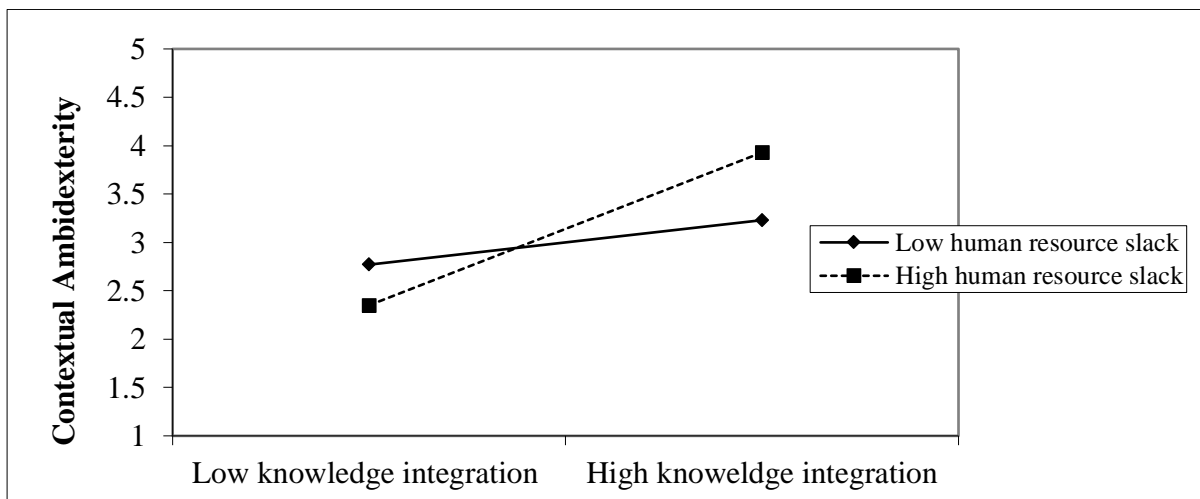
Moderator	Number of innovations				
	Level	Conditional indirect effect	SE	LL 95% CI	UL 95% CI
Human resource slack	Low (-1.03)	0.01	0.03	-0.02	0.03
	High (1.03)	0.09	0.04	0.05	0.14

Results are based on 1000 bootstrap sample

**Table 4b. Moderated mediation results for radicalness of innovation across levels of financial slack**

Moderator	Radicalness of innovation				
	Level	Conditional indirect effect	SE	LL 95% CI	UL 95% CI
Human resource slack	Low (-0.89)	0.02	0.05	-0.01	0.05
	High (0.89)	0.10	0.07	0.08	0.19

Results are based on 1000 bootstrap sample



**Figure 1: Interaction effect of KI with HR slack on CA**



## Appendix 1: Key constructs and items

### Knowledge integration ( $\alpha=0.93$ )

To what extent your firm employs the following mechanisms to integrate scientific and market knowledge:

- Internal committee to select the best innovation opportunities
- Formal meetings among different subunits for screening and evaluating innovation projects
- Use of internal experts or consultants to synthesize project information
- Formal analysis and discussion of past successful innovation projects
- Formal analysis and discussion of past failures in innovation

### Competence exploration ( $\alpha=0.91$ )

Over the last three years, this firm has . . .

- Acquired technologies and skills entirely new to the business
- Learned product development skills and processes entirely new to the industry
- Acquired entirely new managerial and organizational skills that are important for innovation
- Learned new skills for the first time (e.g. funding new technology, staffing R&D function, training, and development of R&D and engineering personnel).
- Strengthened innovation skills in areas where it had no prior experience

### Competence exploitation ( $\alpha=0.88$ )

Over the last three years, this firm has . . .

- Upgraded current knowledge and skills for familiar products and technologies
- Enhanced skills in exploiting well-established technologies that improve the productivity of current innovation operations.
- Enhanced competences in searching for solutions to customer problems that are close to established solutions rather than completely new solutions
- Upgraded skills in product development processes in which the business unit already possessed significant experience
- Strengthened our knowledge and skills for projects that improve the efficiency of existing innovation activities

### Radical innovation ( $\alpha=0.96$ )

Rate how radical each innovation is in terms of:

- Making present products obsolete,
- Fundamentally changing current products or services
- Making existing expertise in prevailing products/service obsolete