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**Examining the institutional implication of the relationship
between the managerial level of education and experience
on firm innovation in Africa**

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3 **An examination of the institutional implication of the relationship between the**
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5 **managerial level of education and experience on firm innovation in Africa**
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8 **Abstract**
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11 **Purpose** - Access to finance and corruption are two major institutional obstacles hindering firm
12 innovation in Africa whose implication on the fit between managerial characteristics and firm
13 innovation has not been examined. The purpose of this research is to examine whether firms
14 may want to hire managers with a good fit when faced with institutional constraints and we
15 suggest managerial level of education and experience within an industry could play a vital role
16 in helping such firms innovate.
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26 **Design/methodology/approach** – Secondary data was obtained from the World Bank
27 Enterprise Survey on 17 African countries and a series of hierarchical regression analyses were
28 conducted to achieve the aim of the research.
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33 **Findings** - Our findings show that while managers with primary and secondary education had
34 a negative relationship with firm innovation (product and process); managers with a university
35 degree had a positive relationship. This level of significance was also confirmed when we split
36 our full sample into two sub-samples (the firms that are institutionally constrained by access to
37 finance and corruption) and therefore confirm the institutional implications of managers fit for
38 firm's innovation.
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48 **Originality** – While research on the effect of management characteristics on firm innovation
49 has focused more on large firms and mostly from developed economies testing both direct and
50 mediation effects, little research exists as to whether the institutional obstacles faced by small
51 firms could influence the type of managers required to drive their innovation.
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57 **Keywords:** **Managerial level of education, Managerial experience, firm innovation,**
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59 **Access to finance, corruption, Africa**
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1 Introduction

A unique characteristic of developing countries especially Africa is its poor institutional quality (Areneke and Kimani, 2019; Zoogah et al., 2015) and the human capital deficiency (Tchamyou and Asongu, 2017) which are at odds with firm innovation. They influence firms to take a conservative attitude toward innovation and discourage risky innovation projects (Doblinger et al., 2016). Developing a positive attitude towards innovation will positively affect innovation (Dibrell et al., 2011). Quality institutions on the other hand will produce more innovation because firms are being encouraged to take a risk and invest in innovation activities (Fernández-Serrano et al., 2019). The success of a firm's innovation within such an uncertain business environment is therefore dependent on the characteristics or attributes posed by its managers (Chen et al., 2019; Wang and Chung, 2013). For Africa to sustain its growth there is the need for strong institutions and better human capital development (Areneke and Kimani, 2019; George et al., 2016). We argue in this research that this conservative attitude towards innovation due to poor institutional quality may have implications on the type of human capital required by managers to successfully drive innovation.

However, our understanding of the institutional implications of the institutional context in which firms operate on firm innovation based on the fit between managerial characteristics and firm innovation has not been examined to the best of our knowledge. This limits our understanding of how policies could be used to influence innovation through human capital development within an institutionally constrained context by enabling firms to have managers who can make strategic decisions and identify and exploit opportunities while maximising available resources (Chen et al., 2019). The lack of slack resources may influence firms to find managers with the best fit for their institutional context (Dong, 2016). The role of the manager in a firm's strategic decision and the outcome is highlighted in the upper echelon theory of (Hambrick, 2007). We address this research gap by examining the relationship between

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3 managerial characteristics and firm innovation for firms that are institutionally constrained in
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5 Africa.
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8 ~~The managerial characteristics considered in this research are level of education and~~
9 ~~industry experience. While they represent some of the most widely examine managerial~~
10 ~~characteristics (Herrmann and Datta, 2005; Mannor et al., 2016; Nadolska and Barkema, 2014;~~
11 ~~Patzelt et al., 2008), their selection is also because lack of managerial experience is a major~~
12 ~~constrain for firm innovation (Fernández-Serrano et al., 2019) and access to education is low~~
13 ~~in Africa with educational and formal institutions poorly developed (Kiggundu, 2002). A~~
14 ~~higher level of education and industrial experience contributes to human capital development~~
15 ~~and managers with such characteristics are more likely to identify opportunities and perform~~
16 ~~better than those who are not (Li et al., 2018) and therefore help firms develop dynamic~~
17 ~~capabilities to sustain their competitive advantage (Dong, 2016; Holzmayer and Schmidt,~~
18 ~~2020).~~
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34 Research examining the relationship between management characteristics and
35 innovation can be broadly divided into two. This includes those focusing on management teams
36 (Lewis et al., 2014; Talke et al., 2011) and those focusing on the manager or CEO of the firm
37 (Holzmayer and Schmidt, 2020; Young et al., 2001). The theoretical argument in both groups
38 of studies is based on the Upper echelon perspective (Hambrick, 2007) which considers
39 management characteristics as proxies for a manager's cognitive abilities and knowledge base
40 and therefore vital for strategic decisions and firm innovation. While these studies have
41 examined the effects of managerial characteristics on firm innovation, they have not considered
42 the institutional implications by which firms that are institutionally constrained may require
43 managers with certain characteristics to help them navigate such constraints and enable them
44 to innovate. ~~This is important because operating with inefficient institutions will require careful~~
45 ~~planning to identify opportunities and maximise scarce resources.~~
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3 Concerning institutional constraints, our research considers access to finance and
4 corruption as among the greatest obstacles facing firms in Africa (Njinyah, 2018; Tajeddin and
5 Carney, 2019; Tchamyou and Asongu, 2017; Zoogah et al., 2015). Institutions as human
6 constraints (Peng et al., 2008) may structure human interactions by creating an unfavourable
7 business environment. Such unfavourable institutions create barriers to innovation (Doblinger
8 et al., 2016). The role of the manager is vital in exploring and interpreting such constraints to
9 drive the firm's innovation (Lewis et al., 2014). Fern'andez-Serrano et al. (2019) show in their
10 study that managerial perception about their institutional context influences their innovation.
11 The research question to be answered therefore is What is the relationship between managers'
12 level of education and industrial experience and firm innovation for firms that are
13 institutionally constrained in Africa?
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29 In answering the above question, we contribute to the existing literature in the following
30 ways: We have developed hypotheses for examining the institutional implications of access to
31 finance and corruption on the fit between managers' level of education and industrial
32 experience on firm innovation in Africa. We found that firms that are institutional constrained
33 (access to finance and corruption as a major obstacle), would require managers with university
34 level of education and industrial experience. Our research combines the institutional and upper
35 echelon theory to provide an alternative understanding of the relationship between managerial
36 characteristics and firm innovation. In addition, we respond to Patzelt et al. (2008) to examine
37 management characteristics in small and medium-sized enterprises (SMEs) as such studies
38 have a focus on top management teams in large firms or organisations and more advanced
39 economies. We compliment Fern'andez-Serrano et al. (2019) who showed how the effect of
40 entrepreneurial characteristics on innovation varies based on whether the region is a high or
41 low-income region. Our complement is based on the fact that we examine managers' level of
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3 education and experience and its effect on innovation for firms that are institutionally
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5 constrained.
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9 Finally, we believe our research context and data are novel. Africa is an intriguing
10 context, as opposed to the Western world, because of the inadequacy of market-supporting
11 institutions and poor contract enforcing mechanisms that pose a challenge for innovation
12 (Collier, 2007). George et al. (2016), argue that the emergence of Africa as the fastest-growing
13 continent should inspire researchers to analyse how this context can inform and extend existing
14 theories in management. Likewise, Bruton et al. (2008) argue that research in Sub-Saharan
15 Africa (SSA) is highly relevant, as emerging economies offer under-explored environments in
16 which to obtain fresh insights to expand theoretical understanding of entrepreneurship and
17 economic development. In the sections that follow, we develop our theoretical perspective and
18 the relationship between the managerial level of education, experience, and firm innovation.
19 We then discuss our methodology and how our data has been analysed. This is followed by the
20 presentation and discussion of the results. Finally, the contribution and limitations of our
21 research are also discussed.
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39 **2 Literature Review**

40 41 42 *2.1 Institutions and Upper Echelon Perspective in Africa*

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45 Institutions are either formal or informal and represent human constraints that structure human
46 interaction (North, 1990; Peng et al., 2008). Institutions, therefore, influence the pace and the
47 extent of entrepreneurship and the entrepreneur's behaviour (Doblinger et al., 2016;
48 Fern'andez-Serrano et al., 2019). Therefore, a favourable institution will reduce transaction
49 costs, and improves business efficiency, and the firm's performance (Peng et al., 2008).
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51 However, an unfavourable institution will discourage risk-taking and innovation and therefore
52 managers will have to be able to analyse the information to make strategic decisions for
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3 innovation. Africa has a rich and complex formal institutional fabric of political, economic,
4 financial, and sociocultural institutions (Zoogah et al., 2015). Our focus here is not to discuss
5 all these different dimensions of institutions but to focus on two (financial – access to finance
6 and political – corruption) that have theoretical and practical implications for innovation in
7 Africa. The theoretical implication is that financially constrained firms will struggle to
8 capitalise on business opportunities and a lack of investment will undermine their ability to
9 function efficiently and innovate (Bottazzi et al., 2014; Guerrero et al., 2018; Musso and
10 Schiavo, 2008; Tagoe et al., 2005). The practical implication is that access to finance is one of
11 the major obstacles to firms' activities in Africa with many small businesses being financially
12 constrained (Asongu and Minkoua N, 2018; Njinyah, 2018; Tajeddin and Carney, 2019).
13 Concerning corruption, the theory suggests it discourages innovation because the money that
14 could have been used for investment is now being diverted to bribes in which case the intended
15 benefit may never be realised (Fisman and Svensson, 2007). Corruption exists in every
16 economy but represents a major challenge for Africa (Zoogha, et al., 2015). This is evident
17 with a report of one in five businesses being expected to give bribes when meeting tax
18 administrators according to the WBES and the rise in anti-corruption strategies in Africa with
19 the assumption that corruption is bad for business (Fisman and Svensson, 2007).
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43 Based on the challenges presented by the above two institutional indicators, firms that
44 are constrained by such institutional factors may be inclined to hire managers with a good fit
45 to help them drive innovation. [The Upper Echelon Theory \(Hambrick and Mason, 1994\)](#) is a
46 widely used theory in entrepreneurship to understand the role of top management (e.g.,
47 managers) within the firm. The theory assumes that managers are responsible for strategic
48 decisions making and implementing strategy to drive innovation within the firm and therefore
49 helps the firm achieves its vision (Talke et al., 2011). The role of the manager, therefore, is
50 crucial and the manager will need to be defined by some characteristics to enable them to drive
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3 innovation (Young et al., 2001). These characteristics represent the manager's cognitive
4 abilities and knowledge based (Hambrick, 2007) to make a valued judgment based on a detailed
5 analysis of information to drive innovation (Herrmann and Datta, 2005). Research on Upper
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[Echelon has therefore examined a range of managerial characteristics and their links to
innovation such as the manager's age, organisation tenure, level of education, functional
background, and international experience among others (Elenkov et al., 2005; Nadolska and
Barkema, 2014; Talke et al., 2011). These studies can be grouped into two main categories
namely those focusing on top management teams (Herrmann and Datta, 2005; Lewis et al.,
2014; Talke et al., 2011) and those focusing on managers or CEOs (Mannor et al., 2016; Young
et al., 2001).

The focus of our research is on the second category (managers of small and medium-sized enterprises (SMEs) and we examine two characteristics namely managers' level of education and managerial experience within an industry based on their implications for firm innovation in Africa. We have focused on three categories of education (primary, secondary and university degrees) based on two viewpoints. From a theoretical viewpoint, managers exhibiting these three categories will have differences in how they drive innovation within their firms especially when constrained by the institutional. From a practical perspective, access to education is low in Africa with educational and formal institutions poorly developed (Kiggundu, 2002) and data from the World Bank shows that these categories define the level of education for many managers in small and medium-sized enterprises in Africa. Also, managers can draw from their experiences and networks to influence innovation (Mannor et al., 2016; Young et al., 2001). With a lack of opportunities in Africa, finding a manager with years of managerial experience within a specific industry may be a big challenge for firms.

2.2 Firm Innovation

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3 The Oslo Manual classifies innovation into two categories namely technological (product and
4 service) and non-technological (market and organisational) innovation. Our dataset is limited
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6 in the sense that it does not capture non-technological innovation and that is why we have
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8 focused our analysis on innovation as product and services. We acknowledge the fact that there
9
10 are other measures of innovation that could be more robust. For example, firms may need more
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12 specialised labour to drive innovation and therefore Andries and Faems (2013) suggest the
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14 proportion of turnover attributed to new products and services as a measure of innovation. Our
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16 dataset does not however provide such measure. Besides, (Baker et al., 2016) have used a
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18 percentage of sales from all innovative products and the frequency of introducing new
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20 products. While our data contains the question of sales from innovative products, very few
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22 respondents have provided an answer to this question probably due to their inability to
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24 distinguish sales that are not associated with innovative products. Adopting such measures
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26 could have reduced our sample size and the strength of our contribution. However, innovation
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28 as a new product and process has been widely used in management research because they
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30 represent good proxies for measuring innovation (Zhang and Li, 2010).
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39 Research has suggested several determinants of innovation, which can be grouped into
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41 internal and external determinants. Internal determinants are those associated with the firm and
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43 may include among others the firm's resources, size, and management (Amara et al., 2010).
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45 Managerial characteristics as discussed above are also an important determinant of firm
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47 innovation because they provide firms with the knowledge to stay competitive (Cannella Jr et
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49 al., 2008). On the other hand, external determinants are those that are external to the firm of
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51 which institutional constraints represent one of many such factors (Fisman and Svensson, 2007;
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53 Peng et al., 2008). Africa suffers from low institutional quality in which firms are being
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55 embedded and managers are required to overcome these institutional barriers to drive
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3 innovation in their firms which makes their role in interpreting such context very important
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5 (Lewis et al., 2014).
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8 *2.3 Managers' Level of Education and Innovation*

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11 Research has an associated level of education with an entrepreneur or manager's cognitive
12 orientation and knowledge base (Herrmann and Datta, 2005). A higher level of education
13 supports the accumulation of knowledge and learning skills that renders one more cognitively
14 able; it also suggests receptivity to new ideas and change (Herrmann and Datta, 2005; Wally
15 and Becerra, 2001). This receptivity to new ideas implies the entrepreneur is open to change,
16 which can be a source of innovation (Patzelt et al., 2008; Young et al., 2001). A higher level
17 of education provides opportunities to gain knowledge about the industry, different markets,
18 and cultures, which is necessary for firms to be competitive (Cannella Jr et al., 2008). The
19 uncertainties of bringing about change are minimised by a higher level of education which
20 provides managers with knowledge of how to exploit opportunities (Li et al., 2018).
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35 However, the relationship between the manager's level of education and firm
36 innovation has been equivocal and contradictory based on mixed results. For example, (Young
37 et al., 2001) reported a positive relationship between a high level of education and in-
38 novation in which managers' level of education was considered as having a management degree.
39 Another positive effect of the level of education was based on Camelo et al. (2010); Herrmann
40 and Datta (2005) whose research focuses on the average level of education for top managers
41 within an organisation. These positive effects are based on the argument that a higher level of
42 education represents a knowledge base for analysing market information to make strategic
43 decisions. On a contrary, Patzelt et al. (2008) reported non-significant results on the effect of a
44 manager's education, which was measured as whether the manager has a formal management
45 education (diploma in business administration or MBA). A non-significant result was also
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3 reported by Chen et al. (2019); Wally and Becerra (2001) in which Wally and Becerra (2001)
4 suggested such a surprising result implies they could be other alternative approaches to
5 understand such effects.
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10 We believe contradictions are based on some contingency factors that have not been
11 taken into consideration. We believe the above studies do not provide a comprehensive view
12 of the relationship between different levels of education as the focus has been more on
13 university degrees which do not provide a direct effect of the other levels of education on firm
14 innovation. One research that examines different levels of education is (Colombelli, 2015)
15 where direct effects of the following were examined (manager's business certificates,
16 postgraduate certificates, and research) and suggest only postgraduate certificates had a
17 significant positive relationship with firms' growth. However, this again excludes managers
18 with primary and secondary degrees. This is particularly important, especially in Africa where
19 there exist many managers with primary and secondary level education due to a prolonged
20 barrier to access to education. A cross-tabulation of our data set show that innovation also takes
21 place in such firms and therefore it is important to examine the relationship between such level
22 of education and firm innovation and therefore suggest such level of education may also be
23 valuable for firm innovation. However, because managers with a lower level of education are
24 unable to collect and analyse complex information about the business environment, we expect
25 this to negatively influence their ability to innovate. This leads to our first hypothesis thus;
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48 H1: There is a direct negative relationship between (a) managers with primary education and
49 (b) managers with secondary education and firm innovation in Africa.
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52 H2: There is a direct positive relationship between managers with university education and
53 firm innovation in Africa.
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57 2.4 *Managerial Experience and Firm Innovation* 58 59 60

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3 Firms are often endowed with different resources that they can exploit to improve their firm's
4 competitiveness through innovation (Holzmayer and Schmidt, 2020). However, Jones-Evans
5 (1997); Mannor et al. (2016) suggest the ability of managers to generate value from the firm's
6 available resources is dependent on the experience that they have accumulated in managing
7 these resources over time. New managers therefore will be deficient in industrial experience
8 and may not be able to maximise resources for strategic decisions in uncertain contexts (Dong,
9 2016). Managerial industrial experience is a source of learning and a learning curve as it
10 facilitates their skills and expertise in different functional areas of the business (Holzmayer and
11 Schmidt, 2020; Li and Zhang, 2007). Experience provides managers with confidence in their
12 abilities to coordinate innovative activities, evaluate performance and help the firm achieves
13 its objectives (Li et al., 2018; Wang and Chung, 2013). Managers with successful industrial
14 experiences from previous employment or industries can transfer these into their present role,
15 replicating this success, and improving the firm performance (Nadolska and Barkema, 2014).
16 In difficult times, therefore, managers can draw on their experience and make appropriate
17 changes to improve the firm's competitiveness (Mannor et al., 2016). Previous experience
18 helps the manager to perceive and manage risk and better deal with uncertainties within the
19 market and such experiences are necessary for strong leadership in times of difficulties (Dong,
20 2016; Jones-Evans, 1997). Experience is also valuable because they facilitate the acquisition
21 of information that is pivotal for innovation and they give the manager confidence in their
22 ability in making the right decision (Herrmann and Datta, 2005; Wang and Chung, 2013).
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50 Studies on the relationship between managerial experience and innovation have also
51 been equivocal and contradictory and based more on advanced economies. For example, (Li
52 and Zhang, 2007) found a significant relationship between a manager's functional experience
53 (sales/marketing, research and development, manufacturing, finance and administration).
54 Young et al. (2001) also found significant relationships in which managerial experience was
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3 measured by whether the manager has previous exposure to similar roles within the same
4 organisation. Herrmann and Datta (2005) reported a significant positive relationship based on
5 the average of the top management team's international experience and international
6 diversification. Wally and Becerra (2001) suggested a non-significance relationship between
7 the top management team's international experience and the firm's international diversification
8 strategy. Patzelt et al. (2008) captures experience based on the average number of years of
9 experience of the top management teams in the industry and suggest there was no significant
10 relationship with the organisation's performance.
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22 While the above studies have focused on advanced economies and one country study,
23 there is a need to explore these issues in another context (Patzelt et al. 2008) and using cross-
24 sectional data could improve our understanding of these relationships. Cross-sectional data
25 using African firms, therefore, provides a novel avenue to examine these relationships and
26 better understand the behaviour of firms. Also, very limited attention has been given to
27 managers of small and medium-sized enterprises (SMEs), especially in Africa. Many SMEs
28 managers do not often exist in teams and the strategic decision of the firms is based on the
29 cognitive ability of their managers. As a result, the managers are responsible for different
30 functional areas of the firm such as sales, marketing, finance and operations, and any other
31 strategic directions the firms want to pursue. The manager in such a context is a "jack of all
32 trades". This makes it appropriate for us to focus on the number of years of managerial
33 experience the manager has within the industry rather than on a specific type of experience.
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50 The manager's industrial experience is a proxy of their cognitive mind, with many firms
51 mirroring the industry experience of their managers, as firms recruit managers based on their
52 experience and the quality of such experience (Stone and Tudor, 2005). Managers can also
53 draw on their industry experience and personal contacts to facilitate valuable alliances with
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3 previous employers, create economies of scale, and develop social capital (Patzelt et al., 2008).

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5 This leads to our third hypothesis thus;

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8 H3: There is a positive direct relationship between managerial industrial experience and firm
9 innovation in Africa.
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11 12 13 2.5 *Implications of Institutional Constraints*

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16 The effect of institutions on firm innovation is a good research area with researchers using
17 different variables to conceptualise institutions. For example, Chen et al. (2019) examine the
18 positive moderating effect of environmental uncertainty between leadership and innovation.
19 Michailova et al. (2013) argued for a negative direct effect between informal institutions
20 (corruption) and weak formal institutions (rule of law and regulatory quality) on firm
21 innovation and performance. While these studies have made enormous contributions to our
22 understanding of the role of an institution on firm innovation, it is not clear whether firms
23 within a low-quality institutional context that constrained their operations will want managers
24 with certain characteristics to help them navigate such difficulties and improve their
25 innovation. Porter (1980) suggested that when firms are constrained by their institutions, they
26 will need to develop strategies to overcome such constraints. We argue that one such strategy
27 may be to recruit managers with specific characteristics to help them innovate. Herrmann and
28 Datta (2005) contributed to the upper echelon theory by arguing that high-performing firms
29 often align their strategies based on the characteristics of their managers. They showed that
30 high-performing firms had a strong match between their team's characteristics and
31 international diversification. We have introduced two new institutional variables, which will
32 enrich our understanding of management characteristics and firm innovation based on other
33 firm characteristics. With limited access to finance, which is further constrained by the
34 challenges posed by corruption, institutionally constrained firms will be able to innovate based
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3 on the extent to which the characteristics of their managers will help them manage their
4 resources in making strategic decisions for innovation. Hypotheses H1, H2 and H3 are based
5 on the above normative view and if they are valid, we expect the relationship to be valid for
6 firms that are institutionally constrained. We, therefore, state our fourth hypothesis;
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13 H4: The positive direct relationship between managers' level of education and firm innovation,
14 managerial industrial experience, and firm innovation is present in firms for which; (a) access
15 to finance and (b) corruption is a major obstacle to business activities.
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20 21 **3 Research Methods**

22 23 *3.1 The Research Context*

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26 The context of this research is Sub-Saharan Africa and involves firms within manufacturing,
27 retail, and other services for which the data is available. Africa is a fast-growing continent,
28 with an average growth rate of 5 per cent, due to an increase in its population/market (World
29 Bank, 2014). This, therefore, positions Africa as a fast-growing market context for new growth
30 opportunities, especially with the rising trend in adopting technology to drive entrepreneurial
31 activities (George et al., 2016). Despite these promising avenues, there are some persistent
32 business challenges, such as the enduring presence of poverty, conflict, political instability,
33 and corruption that threatens Africa's growth (Collier, 2007). The result is deteriorating the
34 ease of doing business (St-Pierre et al., 2015). Another challenge is the continuing presence of
35 institutional voids (George et al., 2016), which also creates opportunities for creative and
36 innovative entrepreneurs to exploit (Rivera-Santos et al., 2015). These challenges make Africa
37 an intriguing context that should inspire researchers to investigate contextual factors that can
38 inform existing entrepreneurship theories (George et al., 2016).
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56 57 *3.2 Data and Sample*

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Our study explores secondary data from the World Bank Enterprise Survey (WBES) database on 17 countries in Africa over a period from 2011 to 2019. These countries include; Cameroon, Central Africa Republic, Chad, Ethiopia, Ivory Coast, Lesotho, Liberia, Malawi, Mali, Morocco, Niger, Nigeria, Rwanda, Sierra Leon, Senegal, Togo, and Tunisia. Tables 4, 5, and 6 show the respective sample sizes for each model. Data collected by WBES are collected from respective sectors of the economy (manufacturing, retail, and other services), to gauge the current investment climate in emerging economies (WBES, 2016). Based on the difficulties in collecting reliable data from Africa (Anosike, 2018), the WBES is seen as a credible and robust data source, which addresses such difficulties. [Participants for the WBES](#) include top management who have a better understanding of the business and how the external environment affects their innovation activities. These respondents include among others the owners, directors, station managers, chief executive officers, and head of HR among others. Table 1 below presents the frequency distribution of our variables about firm innovation.

—————Insert Table 1 About Here —————

Table 1 shows that 54.56 per cent and 58.83 per cent of firms with product and process innovation had managers with a university degree of the firms in our sample with product innovation had managers with a university degree and 58.83 per cent for process innovation. However, we also notice the majority of the firms without product or process innovation were associated with managers with a university degree. Table 1 presents some exciting statistics about the proportion of firms involved in innovation for our different variables.

3.3 Measurement of Variables

3.3.1 Dependent Variable

While Xie et al. (2019) used revenue generated from sales of new products, findings from Ayyagari et al. (2011) suggest the relationship between product innovation and firm

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3 performance is similar, irrespective of the measure of innovation. In this regard, we have
4 measured firm innovation based on questions from the WBES on whether the firm has
5 introduced new or significantly improved products/services? A dummy variable for firm
6 innovation depicts “1” = Yes and “0” No, it has not. For process innovation, in the last three
7 years, has this establishment introduced new or significant improved processes, with “1” = Yes
8 and “0” = No, it has not. It is also worth noting that such innovation may not be new to the
9 market but new to the firm. These measures are widely used in existing studies (Fitjar et al.,
10 2013; Zhang and Li, 2010).
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21 22 *3.3.2 Institutional Variables*

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25 The first institutional variable considered is access to finance. The WBES asked respondents
26 whether access to finance was an obstacle to the firm’s business activities with “1” = Yes and
27 “0” = No. The second institutional variable was corruption in which respondents were also
28 asked whether corruption is a major obstacle to the firm’s business activities with “1” Yes and
29 “0” = No.
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37 38 *3.3.3 Independent Variable*

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40 For the manager’s level of education, a categorical scale was used with “1” = primary
41 education, “2” = secondary education and “3” = university education. Managers’ level of
42 industry experience was a continuous variable, indicating the number of years of experience in
43 the sector, as captured from the WBES. We log normalising this variable to ensure consistency
44 in our measurement. We think experience within the industry over the years provides a more
45 robust managerial experience as suggested by Dong (2016) rather than just considering the
46 length of time a manager has been within a firm.
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57 58 *3.3.4 Control Variable*

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3 Our analysis takes into consideration different levels of control to gauge an alternative
4 explanation of the relationship between the manager's level of education and industrial
5 experience in firms' innovation. We control for the following: 1) Power outages: power outages
6 were measured based on whether the firm has experiences power outages over the past year.
7 This affects innovation because, without a power supply, it is difficult for the firm to innovate,
8 as many of the equipment to be used will not be able to function (McCann and Bahl, 2017). 2)
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Subsidiary: This was measured based on whether the firm is part of a large firm or not with "1" = Yes and "0" = No. Firms that are part of a large firm can leverage external resources more easily to drive their innovation and therefore benefit from economies of scale compared to firms that are not (Mendi and Costamagna, 2017). 3) Competition against unregistered firms: The informal sector in Africa is large and occupied by informal or unregistered firms. These firms are also innovative, and they take a proportion of the market share from the formal firms. This creates competition and research suggests such competition brings about innovation as both firms compete for the market share (McCann and Bahl, 2017). Moreover, intellectual property relating to innovation could be copied by unregistered firms and the fact that these firms could not be held accountable as they are not known to the government could discourage innovation from registered firms (McCann and Bahl, 2017). Respondents were asked whether they compete against unregistered firms with "1" = Yes and "0" = No. 4) Firm size: Research has suggested a positive relationship between firm size and innovation with large firms being more innovative than small firms (Ayyagari et al., 2011). Large firms benefit from more human capital than small firms do. Firms size is measured based on the number of employees with "1" = Small (greater than 5 and less than 20 employees), "2" = medium (20 – 99 employees), and "3" = large firms (above 100 employees). Categorisations are based on data from WBES. 5) Sector effect: we control for sector heterogeneity, as innovation may be influenced by specific sector effects. The three sectors identified in our data are "1" manufacturing, "2" = retail and

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3 service, and “3” = other sectors. 6) Country effect: institutional quality of respective countries
4 may influence innovation differently. We, therefore, control for country effect in which our 17
5 countries were assigned numbers from 1 to 17. Table 2 below provides a summary of our
6 variables, measures, and data source.
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15 16 3.3.5 Common Method Bias

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18 We used a series of techniques to address issues of multicollinearity and common method bias
19 (CMB) which are often associated with survey data. First, we examined the correlation
20 coefficients, and all were within an acceptable range, with none greater than 0.3, as shown in
21 Table 2 below. Moreover, the mean for the variance inflation test (VIF) for each model was
22 below 3 and therefore within an acceptable range (Tabachnick and Fidell, 2007). However, as
23 suggested by Richardson et al. (2009), we are mindful that researchers should try to develop a
24 good research design, as no amount of ex-post analysis could compensate for a bad research
25 design. Good design ensures reliable, valuable, and quality data that minimises the effects of
26 multicollinearity and CMB.
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40 We, therefore, reflect on this to present a brief description of the data collected by the
41 WBES. First, the WBES guarantees participant confidentiality. The questions are written in
42 plain English, for better understanding without any vague terminology and all questions are
43 consistent for every country. All of these, therefore, support participants to provide honest and
44 relevant responses, which could reduce any bias (Chang et al., 2010). Second, participants have
45 to respond to over 50 questions on a different scale. This makes it difficult for them to establish
46 any relationship between their responses, and then recalling the previous response is also more
47 difficult (Baker et al., 2016). Third, as a result of our second point, it is unlikely that the
48 cognitive ability of respective participants from different countries will be the same (Podsakoff
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et al., 2003). The data collection process of the WBES is therefore robust and our ex-post analysis shows that the data used for this research are unlikely to suffer from CMB and multicollinearity issues. Finally, we believe the increasing use of WBES data (Barasa et al., 2017; McCann and Bahl, 2017) is a testimony to the fact that CMB does not threaten their quality.

4 Analysis and Results

We have used probit hierarchical model to analyse our data due to the binary nature of our dependent variable (Innovation). The following equation represents the different models in our analysis and which are linked to the results table (Tables 4, 5 and 6). The starting point in our hierarchical model is to regress the controls against the dependent variable as in equation 1 and linked to Table 4, Model 1 and 2. We then start to add successive independent variables to the controls. Equations 2, 3 and 4 capture the effect of primary, secondary and university education on innovation and this is linked to Table 4, Models 3, 4, 5, 6, 7 and 8. Finally, equation 5 captures the effect of managerial experience on innovation and is also linked to Table 4, Models 9 and 10.

$$\text{Innovation (product and process)} = \beta_0 + \beta_1 \text{Power outage} + \beta_2 \text{Subsidiary firm} + \beta_3 \text{Competition} + \beta_4 \text{Medium firms} + \beta_5 \text{Large firms} + \beta_6 \text{Manufacturing sector} + \beta_7 \text{Retail sector} + E_i \text{-----}(1)$$

$$\text{Innovation (product and process)} = \beta_0 + \beta_1 \text{Primary education} + \beta_2 \text{Power outage} + \beta_3 \text{Subsidiary firm} + \beta_4 \text{Competition} + \beta_5 \text{Medium firms} + \beta_6 \text{Large firms} + \beta_7 \text{Manufacturing sector} + \beta_8 \text{Retail sector} + E_i \text{-----}(2)$$

$$\text{Innovation (product and process)} = \beta_0 + \beta_1 \text{Secondary education} + \beta_2 \text{Power outage} + \beta_3 \text{Subsidiary firm} + \beta_4 \text{Competition} + \beta_5 \text{Medium firms} + \beta_6 \text{Large firms} + \beta_7 \text{Manufacturing sector} + \beta_8 \text{Retail sector} + E_i \text{-----}(3)$$

$$\text{Innovation (product and process)} = \beta_0 + \beta_1 \text{University education} + \beta_2 \text{Power outage} + \beta_3 \text{Subsidiary firm} + \beta_4 \text{Competition} + \beta_5 \text{Medium firms} + \beta_6 \text{Large firms} + \beta_7 \text{Manufacturing sector} + \beta_8 \text{Retail sector} + E_i \text{-----}(4)$$

$$\text{Innovation (product and process)} = \beta_0 + \beta_1 \text{Managerial experience} + \beta_2 \text{Power outage} + \beta_3 \text{Subsidiary firm} + \beta_4 \text{Competition} + \beta_5 \text{Medium firms} + \beta_6 \text{Large firms} + \beta_7 \text{Manufacturing sector} + \beta_8 \text{Retail sector} + E_i \text{-----}(5)$$

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3 From the above equations, β_0 represents the constant, β_1 and β_8 are the coefficients of the
4 independent variables and the control variables respectively, and E is the error term.
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8 Table 3 below presents the descriptive and correlation statistics of the relationship between our
9 variables. We used hierarchical probit regression to analyse our data to examine hypotheses
10 H1, H2, H3, and H4 due to the binary nature of our innovation variable. The starting point was
11 to regress our control variables against firm innovation as shown in table 4 models 1 and 2. In
12 table 4 models 3, 4, and 5, we included a managerial level of education in the analysis including
13 the control variables on product innovation. In table 4 models 6, 7, and 8, we analyse the effect
14 of managerial level of education on process innovation. In table 4 models 9 and 10, we examine
15 the effect of managerial experience on product and process innovation. Finally, to test
16 hypothesis H4, a dummy variable was used to split our sample into two subgroups. The first
17 group was for firms with access to finance (table 5) and corruption (table 6) as a major obstacle.
18 The measurement of these variables is presented in table 2 above.
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37 Table 4 shows that different levels of education will influence innovation differently.
38 Table 4, mode 3 (b = -0.174, SE = 0.080, P = 0.031) and 4 (b = -0.068, SE = 0.034, P = 0.048)
39 shows a direct negative significant relationship between primary education and secondary
40 education on product innovation. This implies the inability of the manager to analyse complex
41 information to make informed strategic decisions due to a lower level of education will
42 significantly and negatively hinder the manager's ability to influence the firm's innovation.
43 These significant relationships were also associated with process innovation with the marginal
44 effects even greater as shown in table 4 models 6 and 7. This, therefore, confirms hypothesis
45 H1 of a direct significant negative relationship between the lower level of education and firm
46 innovation. However, the results shows a direct significant positive relationship between
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3 managers with University degrees and product innovation as shown in table 4 model 5 ($b =$
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5 0.100, $SE = 0.034$, $P = 0.003$) and positive significant effect on process innovation as shown
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7 in table 4 model 8 ($b = 0.199$, $SE = 0.34$, $P = 0.000$). We, therefore, confirm hypothesis H2 of
8
9 a direct positive relationship between managers with a higher level of education (university
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11 degrees) and firm innovation.
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15 Table 4 also presents the result of hypothesis H3. Table 3 model 9 ($b = 0.024$, $SE =$
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17 0.010, $P = 0.023$) and 10 ($b = 0.058$, $SE = 0.010$, $P = 0.000$) indicates strong direct positive
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19 relationships between managerial industrial experience and product and process innovation.
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21 This is an indication of the fact that experience within an industry gives the manager a better
22
23 insight into the complexity and challenges within the industry and how to overcome such
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25 uncertainties by leveraging resources from their network and replicating previous techniques
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27 that have worked in their past employments.
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35 As already discussed above, we had to divide our sample into two to capture the
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37 institutional implications for manager's fits on the relationship between level of education and
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39 industrial experience on firm innovation (hypothesis H4). Table 5 presents the result for the
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41 sample of firms with access to finance as a major constrain. The results as shown in table 5
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43 model 3 ($b = -0.204$, $SE = 0.113$, $P = 0.073$), 4 ($b = -0.118$, $SE = 0.056$, $P = 0.037$), 6 ($b = -$
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45 0.289, $SE = 0.119$, $P = 0.016$) and 7 ($b = -0.138$, $SE = 0.058$, $P = 0.017$) were the same with
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47 that of the full sample as the relationship between managers with primary and secondary level
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49 education and innovation was significantly negative. Moreover, we found a significant positive
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51 relationship between managers with university degrees and firm innovation as shown in table
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53 5 model 5 ($b = 0.187$, $SE = 0.057$, $P = 0.001$) and 8 ($b = 0.223$, $SE = 0.058$, $P = 0.000$). Also,
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55 table 5 model 9 ($b = 0.048$, $SE = 0.017$, $P = 0.006$) and 10 ($b = 0.072$, $SE = 0.018$, $P = 0.000$)
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3 also confirms significant positive relationship between managerial industrial experience and
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5 firm innovation.
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11 In table 6, we examine the implication of corruption as a major obstacle. We found as
12 shown in table 5 model 3 ($b = -0.150$, $SE = 0.107$, $P = 0.161$) and 4 ($b = -0.068$, $SE = 0.045$, P
13 $= 0.140$) that the relationship between managers with primary and secondary education and
14 firm innovation was not significant for product innovation despite being negative. This
15 however shows the inability of such managers to innovate in difficult circumstances. However,
16 their relationships were negatively significant for process innovation as shown in table 6 model
17 6 ($b = -0.295$, $SE = 0.112$, $P = 0.009$) and 7 ($b = -0.081$, $SE = 0.046$, $P = 0.080$). More
18 interestingly, the relationship was positive and significant between managers with university
19 degrees and both product and process innovation as shown in table 6 model 5 ($b = 0.101$, $SE =$
20 0.045 , $P = 0.026$) and 8 ($b = 0.159$, $SE = 0.045$, $P = 0.001$). Finally, we observe a positive and
21 significant relationship between managerial industrial experience and firm innovation as shown
22 in table model 9 ($b = 0.027$, $SE = 0.014$, $P = 0.054$) and 10 ($b = 0.049$, $SE = 0.014$, $P = 0.001$)
23 which was consistent with the result of the full sample.
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42 Our results confirm the existence of direct significant relationships between a
43 manager's level of education (primary, secondary and university degree) and industrial
44 experience in firm innovation. Moreover, firms that are institutionally constrained concerning
45 access to finance and corruption may prefer managers with a good fit for a university degree
46 and experience within the industry to be innovative.
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54 **5 Discussion and conclusion**

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57 In this research, we have provided answers to our research question on “what is the institutional
58 implication of the fit between managerial characteristics and firm innovation. Using a sample
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3 of firms from 17 countries across Africa with available data we have examined the relationship
4 between managers' level of education (primary, secondary and university degree) and industrial
5 experience in firm innovation (product and process in- novation). Important findings were
6 obtained from our analysis. We found a significant negative direct relationship between
7 managers with primary and secondary education and firm innovation. Also, there was a
8 significant positive direct effect between managers with a university degree and firm
9 innovation. Concerning the managerial industry experience, we also obtained a significant
10 positive relationship with the firm's innovation. The institutional implication of access to
11 finance and corruption on the managers fit the firm was also confirmed for both product and
12 process innovation, especially with university education and managerial industry experience.

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27 The above findings contribute to the existing literature in three ways. First, we have
28 combined the Upper echelon (Hambrick, 2007) and institutional theory (North, 1990) to
29 develop hypotheses that foster our understanding of management characteristics on firm
30 innovation. We showed that firms that are institutionally constrained will need managers with
31 a high level of human capital (university education and industrial experience) to help them
32 exploit their context and be innovative. Alternatively, we showed that the value of managers'
33 education and experience to the firm is better captured when the firms are facing difficulties
34 and need better decision-making. To demonstrate this fit, we first examine the effect of
35 different levels of education and industrial experience on innovation. Then we perform the
36 same regression based on our sub-sample of firms (those constrained by access to finance and
37 corruption). We expect the relationship between levels of education and industrial experience
38 with innovation to be significant for both samples. Our predictions were confirmed. The
39 implication, therefore, is that in a context with low institutional quality, innovative firms are
40 inclined to find managers with a good fit for specific types of constraints they may be faced
41 with. Our literature review shows that such context presents business uncertainties and the role
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3 of the manager for innovative firms is very important (Chen et al., 2019; Wang and Chung,
4 2013). With a university degree, they will be able to scan the market for opportunities and
5 collect and analyse complex information for decision-making to influence innovation.
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7 Moreover, with experience within the industry, managers can obtain external resources, seek
8 advice from their networks, and apply best practices in their previous jobs, which are all
9 requirements to influence innovation.

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11 Second, we advance the literature on management characteristics and firm innovation.
12 Previous studies on management characteristics and firm innovation have focused more on top
13 management teams in developed economies and associated with manufacturing firms (e.g.,
14 (Herrmann and Datta, 2005; Patzelt et al., 2008; P´erez et al., 2019; Talke et al., 2011). While
15 such manufacturing firms are capital intensive and the heterogeneity of their top management
16 team makes them more innovative, the case of managers who do not work in teams is different.
17 However, studies that do not focus on top management teams have also been based on large
18 firms or organisations such as technology ventures (Li and Zhang, 2007), health
19 organisations/hospitals (Mannor et al., 2016; Young et al., 2001), and public firms (Dong,
20 2016). We contribute to these studies by focusing on managers of SMEs in Africa as a response
21 (Patzelt et al., 2008). We contribute to the above studies by examining the institutional
22 implications of the fit between management characteristics and firm innovation for firms that
23 are institutionally constrained. The decision-making process for these managers is different
24 from those working in teams as it involves them using their cognitive ability to make quick
25 decisions without any challenge to address specific problems or implement their strategy. With
26 a high level of education and industrial experience, they are therefore equipped to make correct
27 decisions when faced with such constraints.

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29 Third, our research finds support, contradictions from and complements existing
30 research on management characteristics. We have demonstrated that managerial experience

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3 within an industry is a significant positive determinant of firm innovation. This finding
4 confirms Young et al. (2001) who found managers' previous exposure to total quality
5 management in a hospital to have a positive significant relationship with the hospital's adoption
6 of TQM. However, we contradict (Li and Zhang, 2007) who found a negative and non-
7 significant relationship between managerial experience and firm performance. We complement
8 these previous researches based on our measurement of managerial experience. For example,
9 Young et al. (2001) asked managers whether they have had previous exposure to management
10 within a specific organization (hospital) while (Li and Zhang, 2007) consider the average
11 number of years the manager has had in the current industry (Technology sector) and Dong
12 (2016) on years of managerial experience in their current firm. We have focused on the number
13 of years of managerial experience within the industry and this cuts across different industries
14 as discussed in our measurement of variables. This, therefore, makes our contribution more
15 applicable to a broader spectrum of firms in Africa due to similar institutional constraints.
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34 Based on the above, policy and management are suggested. Firstly, for firms that are
35 institutionally constrained, our findings provide them with the need to hire managers that are
36 well educated and have industrial experience. Such managers will be able to use their
37 experiences in decision-making, strategy formulation and implementation and networks
38 developed while working for other firms in the industry to effectively and efficiently manage
39 resources within such constraints to drive innovation. With their high level of education, they
40 can sport opportunities and threats, and collect and analyse market information to make
41 strategic decisions for innovation. Their experiences of dealing with such institutional constrain
42 are, therefore, invaluable human capital for the firm. Second, policy improvement through anti-
43 corruption strategies and providing firms with access to finance such as the creation of SMEs
44 bank in Cameroon may reduce business uncertainty and improve investment in innovative
45 products. Finally, access to education is a barrier to human capital development in Africa. Due
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3 to poverty, providing affordable education and opening universities in rural communities will
4 encourage people to take up university education and gain the skills and knowledge to analyse
5 complex information to drive innovation.
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11 Our research, however, has some limitations. First, we have focused on access to
12 finance and corruption as an institutional obstacles to examining their implications on the
13 manager's fit in improving innovation. While these two were theoretically relevant to the
14 African context, institutions do not just exist as constraints but also as facilitators in creating
15 an enabling business environment. Therefore, future research should explore the implication
16 of other institutional dimensions. Also, the use of cross-sectional data does not permit us to
17 analyse the effect over time. As more data from the WBES becomes available, future research
18 can build data to examine these effects over time. Our dependent variable is a subjective
19 measure of innovation, which may be subjected to common method bias. Despite us providing
20 a robust argument as to why common method bias is not a threat to the data, future research
21 can use more objective variables such as the number of sales from all innovative products or
22 the amount of investment in research and development.
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39 Also, it is most likely that some managers may have obtained their university degrees
40 and experiences abroad where the quality of education may be different from those in their
41 home country. However, our data do not permit us to capture such differences. We suggest
42 future research to explore the difference in the effect of university degrees and experiences
43 obtained from abroad and that obtained from the home country on a firm's innovation. This is
44 important because why Africa suffers from low-quality education; many Africans are travelling
45 abroad to obtain better quality education and the effects of such education on firm innovation
46 need to be examined. In addition, many firms will want managers with a certain level of
47 managerial experience within the industry. However, it is not clear what level of experience is
48 desirable for innovation. Future research can categorise industrial experience for various ranges
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3 such as (e.g., 2 years, 4 years, 6 years, 8 years, and 10 years among others) and examine their
4 effect on innovation to provide firms with a better guide on the most desirable level of industrial
5 experience needed for innovation. Finally, innovative ideas can also come from close
6 collaborators or subordinates who are not managers and research should also consider the
7 impact of such ideas on the firms' innovation.
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15 **Disclosure statement**

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18 No potential conflict of interest was reported by the author.
19

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Table 1. Frequency distribution of variables and firm innovation

Variable	Product Innovation			Process Innovation		
	Frequencies			Frequencies		
	No	Yes	Cumulative %	No	Yes	Cumulative %
Education						
Primary education	171 (4.55)	110 (3.87)	281 (4.26)	208 (4.88)	76 (3.27)	284 (4.31)
Secondary education	1,667 (44.36)	1,181 (41.57)	2,848 (43.16)	1,967 (46.11)	882 (37.90)	2,849 (43.21)
University education	1,920 (51.09)	1,550 (54.56)	3,470 (52.58)	2,091 (49.02)	1,369 (58.83)	3,460 (52.48)
	3,758 (100.00)	2,841 (100.00)	6,599 (100.00)	4,266 (100.00)	2,327 (100.00)	6,593 (100.00)
Power Outages						
No	1,343 (35.30)	671 (23.34)	2,014 (30.15)	1,451 (33.54)	563 (23.96)	2,014 (30.17)
Yes	2,462 (64.70)	2,204 (76.66)	4,666 (69.85)	2,875 (66.46)	1,787 (76.04)	4,662 (69.83)
	3,805 (100.00)	2,875 (100.00)	6,680 (100.00)	4,326 (100.00)	2,350 (100.00)	6,676 (100.00)
Subsidiary firm						
No	2,603 (76.67)	2,025 (74.23)	4,628 (75.58)	2,999 (76.86)	1,627 (73.39)	4,626 (75.60)
Yes	792 (23.33)	703 (25.77)	1,495 (24.42)	903 (23.14)	590 (26.61)	1,493 (24.40)
	3,395 (100.00)	2,728 (100.00)	6,123 (100.00)	3,902 (100.00)	2,217 (100.00)	6,119 (100.00)
Compete with unregistered firms						
No	1,700 (46.70)	1,118 (40.43)	2,818 (44.00)	1,812 (43.93)	1,010 (44.30)	2,822 (44.06)
Yes	1,940 (53.30)	1,647 (59.57)	3,587 (56.00)	2,313 (56.07)	1,270 (55.70)	3,583 (55.94)
	3,640 (100.00)	2,765 (100.00)	6,405 (100.00)	4,125 (100.00)	2,280 (100.00)	6,405 (100.00)
Firm size						
Small	2,272 (59.40)	1,552 (53.72)	3,824 (56.96)	2,673 (61.49)	1,151 (48.77)	3,824 (57.02)
Medium	1,135 (29.67)	941 (32.57)	2,076 (30.92)	1,253 (28.82)	818 (34.66)	2,071 (30.88)
Large	418 (10.93)	396 (13.71)	814 (12.12)	421 (9.68)	391 (16.57)	812 (12.11)
	3,825 (100.00)	2,889 (100.00)	6,714 (100.00)	4,347 (100.00)	2,360 (100.00)	6,707 (100.00)

..... table 1 continues

Variable	Product Innovation			Process Innovation		
	Frequencies			Frequencies		
	No	Yes	Cumulative %	No	Yes	Cumulative %
Sectors						
Manufacturing	1,653 (43.20)	1,279 (44.27)	2,932 (43.66)	1,893 (43.55)	1,033 (43.75)	2,926 (43.62)
Retail/Service	1,109 (28.99)	912 (31.57)	2,021 (30.10)	1,320 (30.37)	705 (29.86)	2,025 (30.19)
Other	1,064 (27.81)	698 (24.16)	1,762 (26.24)	1,134 (26.09)	623 (26.39)	1,757 (26.19)
	3,826 (100.00)	2,889 (100.00)	6,715 (100.00)	4,347 (100.00)	2,361 (100.00)	6,708 (100.00)
Access to finance						
No	2,576 (67.33)	1,903 (65.87)	4,479 (66.70)	2,891 (66.51)	1,579 (966.88)	4,470 (66.64)
Yes	1,250 (32.67)	986 (34.13)	2,236 (33.30)	1,456 (33.49)	782 (33.12)	2,238 (33.36)
	3,826 (100.00)	2,889 (100.00)	6,715 (100.00)	4,347 (100.00)	2,361 (100.00)	6,708 (100.00)
Corruption						
No	2,963 (77.44)	2,120 (73.38)	5,083 (75.70)	3,418 (78.63)	1,664 (70.48)	5,082 (75.76)
Yes	863 (22.56)	769 (26.62)	1,632 (24.30)	929 (21.37)	697 (29.52)	1,626 (24.24)
	3,826 (100.00)	2,889 (100.00)	6,715 (100.00)	4,347 (100.00)	2,361 (100.00)	6,708 (100.00)

Table 2. Variable Description

Variables	Measure	Data Source
Process Innovation	A dummy variable coded as '1' if a firm introduces new processes and "0" if not.	WBES
Product Innovation	A dummy variable, coded as '1' if a firm introduces new product/service and "0" if not.	WBES
Primary Education	A dummy variable coded as "1" if the manager highest level of education is primary education and "0" if it is not.	WBES
Secondary Education	A dummy variable coded as "1" if the manager highest level of education is secondary education and "0" if it is not.	WBES
University Education	A dummy variable coded as "1" if the manager highest level of education is university education and "0" if it is not.	WBES
Managers experience	A continues variables on the number of years of experience the manager has in the industry (log)	WBES
Power Outages	A dummy variable, code as "1" if the firm experiences power outages in the last year and "0" if not.	WBES
Competition with unregistered firms	A dummy variable coded as "1" if the firm compete against unregistered or informal firms and "0" if not.	WBES
A subsidiary firm	A dummy variable, code as "1" if the firm is part of a large establishment and "0" if not.	WBES
Firm size	A categorical variable coded as "1" = small firms, "2" = medium and "3" = large	WBES
Sector	A categorical variable coded as "1" if it is a manufacturing sector, "2" = retail services and "3" = other services.	WBES
Corruption as a major obstacle	A dummy variable, code as "1" if the firm sees corruption as a major obstacle to its business activities and "0" if not.	WBES
Access to finance as a major obstacle	A dummy variable, code as "1" if the firm access to finance is a major obstacle to its business activities and "0" if not.	WBES
Country	A categorical variable with "1" = Cameroon to "17" = Tunisia (see list of countries in section 3.2)	WBES

Table 3. Descriptive and correlations statistics

	1	2	3	4	5	6	7	8	9	10	11
Product Innovation (1)	1.000										
	(0.000)										
Process Innovation (2)	0.415	1.000									
	(0.000)	(0.000)									
Managers Education (3)	0.045	0.100	1.000								
	(0.001)	(0.000)	(0.000)								
Managers Experience (4)	0.032	0.090	0.836	1.000							
	(0.017)	(0.000)	(0.000)	(0.000)							
Power Outages (5)	0.099	0.083	0.014	0.020	1.000						
	(0.000)	(0.000)	(0.290)	(0.131)	(0.000)						
Access to Finance (6)	0.071	0.115	0.087	0.074	0.005	1.000					
	(0.000)	(0.000)	(0.000)	(0.000)	(0.722)	(0.000)					
Competitions against Unregistered firms (7)	0.056	-0.003	-0.122	-0.108	0.070	0.008	1.000				
	(0.000)	(0.835)	(0.000)	(0.000)	(0.000)	(0.556)	(0.000)				
Corruption (8)	0.068	0.115	0.013	-0.018	-0.002	-0.052	0.005	1.000			
	(0.000)	(0.000)	(0.330)	(0.180)	(0.867)	(0.000)	(0.732)	(0.000)			
Subsidiary Firm (9)	0.033	0.036	0.079	0.072	0.058	0.071	0.011	-0.046	1.000		
	(0.014)	(0.007)	(0.000)	(0.000)	(0.000)	(0.000)	(0.398)	(0.001)	(0.000)		
Firm Size (10)	0.053	0.120	0.159	0.157	0.024	0.145	-0.103	-0.043	0.128	1.000	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.070)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	
Sector (11)	-0.031	0.003	0.039	0.052	0.048	0.064	0.023	-0.118	0.032	0.011	1.000
	(0.021)	(0.812)	(0.004)	(0.000)	(0.000)	(0.000)	(0.091)	(0.000)	(0.019)	(0.427)	(0.000)
N	6715	6708	6654	6771	6734	6547	6451	6774	6181	6772	6773
Mean	0.430	0.354	2.482	1.497	0.698	0.227	0.559	0.242	0.245	1.553	1.824
SD	0.495	0.478	0.579	1.614	0.458	0.419	0.496	0.428	0.430	0.701	0.816
Min	0	0	1	0	0	0	0	0	0	1	1
Max	1	1	3	4.234107	1	1	1	1	1	3	3
Robust P value in parentheses; *** p<0.01, ** p<0.05, * p<0.1											

Table 4. Regression Results for the full sample

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Variables	Prod. Ino.	Proc. Ino.	Prod. Ino.	Prod. Ino.	Prod. Ino.	Proc. Ino.	Proc. Ino.	Proc. Ino.	Prod. Ino.	Proc. Ino.
Power outages	0.278***	0.245***	0.278***	0.277***	0.277***	0.245***	0.245***	0.245***	0.277***	0.243***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
A subsidiary firm	0.059	0.051	0.059	0.053	0.051	0.052	0.041	0.037	0.054	0.041
	(0.132)	(0.194)	(0.128)	(0.172)	(0.188)	(0.185)	(0.301)	(0.354)	(0.163)	(0.302)
Compete against unregistered firms	0.144***	0.006	0.149***	0.148***	0.154***	0.015	0.015	0.026	0.151***	0.024
	(0.000)	(0.872)	(0.000)	(0.000)	(0.000)	(0.668)	(0.658)	(0.452)	(0.000)	(0.488)
Medium firms	0.066*	0.202***	0.066*	0.058	0.056	0.203***	0.187***	0.182***	0.061*	0.189***
	(0.071)	(0.000)	(0.069)	(0.112)	(0.129)	(0.000)	(0.000)	(0.000)	(0.098)	(0.000)
Large firms	0.252***	0.458***	0.251***	0.236***	0.230***	0.456***	0.427***	0.415***	0.236***	0.421***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Manufacturing sector	0.014	0.006	0.010	0.012	0.010	0.001	0.004	0.000	0.012	0.002
	(0.730)	(0.879)	(0.791)	(0.755)	(0.792)	(0.983)	(0.923)	(0.993)	(0.768)	(0.968)
Retail sector	-0.117***	-0.003	-0.115***	-0.121***	-0.123***	0.000	-0.012	-0.015	-0.122***	-0.015
	(0.005)	(0.940)	(0.006)	(0.004)	(0.003)	(0.997)	(0.786)	(0.732)	(0.004)	(0.732)
Primary education			-0.174**			-0.319***				
			(0.031)			(0.000)				
Secondary education				-0.068**			-0.133***			
				(0.048)			(0.000)			
University education					0.100***			0.199***		
					(0.003)			(0.000)		
Managerial experience									0.024**	0.058***
									(0.023)	(0.000)
Year and country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.465***	-0.668***	-0.459***	-0.430***	-0.510***	-0.659***	-0.602***	-0.761***	-0.496***	-0.748***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	5,788	5,791	5,788	5,788	5,788	5,791	5,791	5,791	5,788	5,791
Wald chi2	102.61	125.69	107.24	106.49	111.26	140.77	139.91	158.49	107.79	155.34
Prob > chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mean VIF	1.69	1.69	1.61	1.72	1.76	1.61	1.71	1.76	1.73	1.73
Robust P value in parentheses: *** p<0.01, ** p<0.05, * p<0.1										

Table 5. Result on access to finance sub sample

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Variables	Prod. Ino.	Proc. Ino	Prod. Ino.	Prod. Ino.	Prod. Ino.	Proc. Ino.	Proc. Ino.	Proc. Ino.	Prod. Ino.	Proc. Ino
Power outages	0.239***	0.180**	0.236***	0.244***	0.244***	0.176**	0.187**	0.189**	0.238***	0.181**
	(0.001)	(0.014)	(0.001)	(0.001)	(0.001)	(0.017)	(0.011)	(0.010)	(0.001)	(0.014)
A subsidiary firm	0.062	0.079	0.063	0.054	0.049	0.081	0.068	0.062	0.054	0.066
	(0.354)	(0.246)	(0.345)	(0.423)	(0.468)	(0.232)	(0.314)	(0.357)	(0.423)	(0.327)
Compete against unregistered firms	0.249***	-0.033	0.256***	0.251***	0.261***	-0.023	-0.031	-0.021	0.260***	-0.018
	(0.000)	(0.589)	(0.000)	(0.000)	(0.000)	(0.702)	(0.614)	(0.737)	(0.000)	(0.767)
Medium firms	0.043	0.192***	0.049	0.037	0.040	0.200***	0.186***	0.190***	0.043	0.194***
	(0.479)	(0.002)	(0.426)	(0.545)	(0.519)	(0.001)	(0.003)	(0.002)	(0.480)	(0.002)
Large firms	0.241**	0.547***	0.239**	0.221**	0.209**	0.545***	0.524***	0.510***	0.211**	0.503***
	(0.021)	(0.000)	(0.022)	(0.035)	(0.046)	(0.000)	(0.000)	(0.000)	(0.045)	(0.000)
Manufacturing sector	0.060	-0.053	0.055	0.060	0.054	-0.061	-0.053	-0.060	0.060	-0.053
	(0.394)	(0.464)	(0.441)	(0.397)	(0.448)	(0.402)	(0.466)	(0.412)	(0.398)	(0.469)
Retail sector	-0.038	-0.005	-0.039	-0.043	-0.047	-0.006	-0.010	-0.014	-0.046	-0.016
	(0.564)	(0.941)	(0.551)	(0.516)	(0.481)	(0.932)	(0.877)	(0.832)	(0.489)	(0.818)
Primary education			-0.204*			-0.289**				
			(0.073)			(0.016)				
Secondary education				-0.119**			-0.139**			
				(0.037)			(0.017)			
University education					0.187***			0.223***		
					(0.001)			(0.000)		
Managerial experience									0.049***	0.073***
									(0.006)	(0.000)
Year and country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.532***	-0.601***	-0.520***	-0.474***	-0.617***	-0.586***	-0.536***	-0.707***	-0.596***	-0.701***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	2,016	2,017	2,016	2,016	2,016	2,017	2,017	2,017	2,016	2,017
Wald chi2	37.1	42.49	39.92	41.61	47.65	48.14	48.51	57.57	44.59	58.72
Prob > chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mean VIF	1.8	1.8	1.71	1.83	1.82	1.71	1.83	1.82	1.8	1.8
Robust P value in parentheses: *** p<0.01, ** p<0.05, * p<0.1										

Table 6. Result on corruption sub sample

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Variable	Prod. Ino.	Proc. Ino	Prod. Ino.	Prod. Ino.	Prod. Ino.	Proc. Ino.	Proc. Ino.	Proc. Ino.	Prod. Ino.	Proc. Ino
Power outages	0.344***	0.228***	0.344***	0.342***	0.342***	0.228***	0.227***	0.226***	0.340***	0.223***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
A subsidiary firm	0.141***	0.109**	0.143***	0.135**	0.133**	0.113**	0.101*	0.095*	0.136**	0.099*
	(0.008)	(0.041)	(0.007)	(0.011)	(0.012)	(0.035)	(0.058)	(0.074)	(0.010)	(0.062)
Compete against unregistered firms	0.088*	0.002	0.091**	0.091**	0.096**	0.007	0.006	0.015	0.095**	0.016
	(0.057)	(0.974)	(0.049)	(0.048)	(0.038)	(0.877)	(0.893)	(0.753)	(0.040)	(0.735)
Medium firms	0.041	0.158***	0.043	0.034	0.032	0.162***	0.150***	0.145***	0.037	0.151***
	(0.395)	(0.001)	(0.379)	(0.479)	(0.504)	(0.001)	(0.002)	(0.003)	(0.451)	(0.002)
Large firms	0.231***	0.366***	0.232***	0.214**	0.210**	0.368***	0.346***	0.334***	0.214**	0.336***
	(0.005)	(0.000)	(0.005)	(0.010)	(0.012)	(0.000)	(0.000)	(0.000)	(0.010)	(0.000)
Manufacturing sector	0.003	0.030	0.000	0.001	-0.000	0.025	0.029	0.025	0.001	0.027
	(0.956)	(0.558)	(0.996)	(0.977)	(0.994)	(0.625)	(0.579)	(0.625)	(0.981)	(0.601)
Retail sector	-0.107*	-0.084	-0.102*	-0.113*	-0.113*	-0.075	-0.092	-0.095	-0.112*	-0.095
	(0.070)	(0.160)	(0.081)	(0.055)	(0.054)	(0.210)	(0.125)	(0.115)	(0.056)	(0.116)
Primary education			-0.150			-0.295***				
			(0.161)			(0.009)				
Secondary education				-0.068			-0.081*			
				(0.140)			(0.080)			
University education					0.101**			0.159***		
					(0.026)			(0.001)		
Managerial experience									0.027*	0.049***
									(0.054)	(0.001)
Year and country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.465***	-0.604***	-0.461***	-0.429***	-0.509***	-0.598***	-0.562***	-0.676***	-0.500***	-0.669***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	3,228	3,225	3,228	3,228	3,228	3,225	3,225	3,225	3,228	3,225
Wald chi2	69.08	53.6	71.11	71.07	73.96	60.36	56.65	65.58	72.81	65.18
Prob > chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mean VIF	1.73	1.73	1.65	1.75	1.79	1.65	1.75	1.78	1.76	1.76
Robust P value in parentheses: *** p<0.01, ** p<0.05, * p<0.1										

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