

# Institutions, Resources and Innovation in Developng Countries

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# INSTITUTIONS, RESOURCES AND INNOVATION IN DEVELOPING COUNTRIES: A FIRM LEVEL APPROACH

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# INSTITUTIONS, RESOURCES AND INNOVATION IN DEVELOPING COUNTRIES: A FIRM LEVEL APPROACH


## ABSTRACT

This study examines how firm-level resources interact with regional institutional quality to explain innovation in developing countries. We hypothesize that the institutional environment within which the firm operates moderates the effect of firm-level resources on innovative output. We examine the moderating role of institutions with regards to the transformation of firm-level resources including internal research and development, employee level of education and quality certification into innovative output using firm-level data from the World Bank Enterprise Survey and the Innovation Follow-up Survey that includes the innovation module for the years 2010 through 2012. We test our hypotheses using a multilevel logistic model. We find that the effects of firm-level resources vary depending on the institutional environment and that regional institutional quality positively moderates the effects of the firm-level resources. The positive effects of internal research and development on innovative output are substantially reinforced by regional institutional quality.



**Keywords:** Firm-level resources, regional institutional quality, innovative output, developing countries, multilevel logistic model

## INTRODUCTION

Innovation has been considered a key driver for economic growth, enhancing competitive advantage and stimulating the productivity of firms (Schumpeter, 1934; Rothwell & Zegveld, 1982; Fischer, 2001) in developed and developing countries alike (Chudnovsky et al., 2006; Crespi & Zuniga, 2011). Individual firms play a key role in developing innovations, but the process of innovation involves "a complex web of interactions among a range of firms, other organizations and institutions" (Fischer, 2001: 200). Firms in developing countries struggle with a specific set of challenges that influence innovation (Bradley et al., 2012). These largely pertain to two dominant factors.

The first factor is related to specific firm-level resources and capabilities. As indicated in previous research, firm resources are directly related to "the search for, absorption of and generation of new technology" (Srholec, 2011: 1545). Firm-level resources allow firms to distinguish themselves from their competitors. According to the resource-based view of the firm, this is only possible, however, when resources are valuable, rare, inimitable and non-substitutable (Barney, 1991). The main problem for competitors to imitate a successful resource base is the time it takes to create and develop such resources and the causal ambiguity surrounding these resources, which makes it difficult to identify exactly what resources lead to competitive advantage (Peteraf, 1993). Firms in developing countries operate below the technology frontier with lower levels of managerial and production skills (Goedhuys, 2007; Goedhuys & Sleuwaegen, 2010). Yet, also in developing countries, firms require resources, competences and skills, which can be build up through R&D or training, to become innovative (Goedhuys et al., 2014). Barney (2001) argued that the value of these firm resources must be understood in the broader context in which the firm is embedded. In other words, even if a firm

possesses valuable, rare, inimitable and non-substitutable resources, the extent to which it can extract value from them is likely to depend on the environment of the firm (Sirmon et al., 2007). Hence, merely possessing firm resources is not enough to extract value from them and, in our case, develop new innovative products. This brings us to the second challenge firms in developing countries face.

The second factor is the *regional* institutional environment within which the firm is embedded. Notwithstanding the importance of country-level institutions, we argue that the quality of institutions will also significantly differ across regions in a country. Regions can be characterized by a specific set of formal (laws, rules and regulations) and informal institutions (norms and values) (cf. North, 1990) that function as durable structures specific to the territory (Boschma & Frenken, 2009). Regions in developing countries are often culturally, politically and economically heterogeneous. In addition, within-country variation in the implementation of formal institutions is also likely to exist in large and complex countries (Shi et al., 2012). In line with Laursen et al. (2012) we contend that the regional environment affects the ability of firms to introduce new innovations. Yet, perhaps more importantly, we argue that poor regional institutional quality within a focal country makes it more difficult to extract value from a firm's resources that are needed to innovate. Poor institutional quality, or the presence of weak institutions, has been reported to undermine the functioning of factor markets, increase transaction costs and magnify information asymmetries (Meyer et al., 2009), which has a negative effect on the possibilities to extract value from current resources. As such, we infer that the extent to which firms can successfully use their resources to innovate is likely to differ between regions due to differences in regional institutional quality. Thus, it is critical that we understand how the regional institutional environment of a firm influences the transformation of

firm-level resources into innovative output for firms in developing countries (Fagerberg et al., 2010; Martin-de Castro et al., 2013).

In our study, innovation refers to product innovation, which is defined as the introduction of a new good or service including significant improvement of an existing product with respect to characteristics and intended uses (Oslo Manual, 2005; Ayyagari, 2012; Chadee & Roxas, 2013). While there are numerous studies examining innovation, most investigate the determinants of innovation in the context of advanced economies (De Jong & Vermeulen, 2006; De Mel et al., 2009; McAdam et al., 2014). The findings of these studies have limited implications for innovation in developing economies due to the disparities in institutional quality at the regional-level. Regional institutional quality refers to a situation in which there is low corruption, a strong rule of law and a high degree of regulatory quality within a region. There are few empirical studies examining how regional institutional quality affects the strength of the relationship between firm-level resources and innovative output in developing countries. This may be attributed to the fact that data on innovation in developing countries has been unavailable only until recently or was not collected in a systematic manner (Ayyagari et al., 2012). This warrants an investigation into how regional institutional quality influences the ability of firms to extract value from their resources. In our case, value extraction is represented by the innovative output of firms.

Our study makes two contributions. First, it sheds light on the micro level relation between firm-level resources and innovation in developing countries, an area of study that has only received scarce attention for a long time due to the absence of firm level data (e.g. Goedhuys et al., 2014). Second, this study deepens the understanding of how the regional institutional environment interacts with firm-level resources to explain the innovative output of firms in

developing countries. We argue that regional heterogeneity within countries gives rise to variation in regional institutional quality (cf. Picard et al., 2006). Taking into account the different cultures and governance systems, we expect that the variation in regional institutional quality is likely to influence the relation between firm resources and innovation. As such, our study empirically investigates how the regional institutional environment influences the extent to which firms are able to extract value from their resources for innovative output.

## THEORETICAL BACKGROUND

There is broad consensus that firm-specific investments in innovation and R&D raise the growth opportunities for firms (e.g. Goedhuys, 2007; Geroski, 2000; Goedhuys & Sleuwaegen, 2010). Firm-level resources that are known to drive innovation include internal R&D, training, information search, communication facilitities, human capital and a variety of input factors (e.g. Tybout, 2000; Goedhuys, 2007; Goedhuys & Sleuwaegen, 2010; Srholec, 2011; Crespi & Zuniga, 2011; Bradley et al., 2012).

Our study focuses on three firm-level resources that have received much attention in prior studies on innovation in developing countries: internal R&D, education level of employees, and quality certification. R&D expenditures, frequently used as a measure for innovation input (Arundel et al., 2008) are crucial for innovation at the firm level (Levin et al. 1987). The relation between internal R&D and innovation is mixed for developing countries (see Crespi & Zuniga, 2011). While several studies report a positive association between R&D and innovation in Asia (see Lee & Kang, 2009; Wang & Lin, 2013), evidence from Chile and Mexico does not support this finding (Crespi & Zuniga, 2011). For African countries, Goedhuys (2007) shows a positive relation between R&D and product innovation in Tanzania. In addition, Kamau and Munandi (2009) argue that R&D is an important component of innovation based strategy for clothing and

textile manufacturers in Kenya. McGuirk and Lenihan, (2013) argue that the role of individuals and the significance of their contribution to innovation activities is now widely recognized. The level of education of employees is crucial for firm-level productivity.

The importance of education for innovation has been demonstrated for developing countries as well (Kim & Nelson, 2000; Amann & Cantwell, 2012). For instance, Robson et al. (2009) find a positive relation between education level and innovation in Ghana. Moreover, Kamau and Munandi (2009) report that clothing and textile manufacturers in Kenya prefer hiring individuals with secondary school as opposed to those with only primary education because such employees easily absorb knowledge which is crucial to innovation. With respect to quality certification, Pekovic and Galia (2009) claim that quality encompasses human and technological dimensions that are imperative in promoting an environment that supports innovation (see also Kanji, 1996; Roffe, 1999; Sanz Cañada & Macías Vázquez, 2005; Lorente et al., 2009), also in developing countries (Hoang et al., 2006). In contrast, Glynn (1996) argues that quality certification requirements such as standardization that enables conformity may not be necessarily conducive to innovation because they give rise to rigidity. Although quality certification is mainly a requirement for firms supplying in high quality markets, which reflects an emphasis on operational product activities, we argue, in line with Fagerberg & Shrolec (2008: 1421), that quality certification is an element of a technological capability that influences the development, diffusion and use of innovations in developing countries.

Our study also includes the broader institutional environment in which firms are embedded for exploring the relationship between firm-resources and innovation in developing countries. Poor governance characterizes a majority of developing countries, implying the existence of institutions that are not well-functioning (Abed & Gupta, 2002). Olson et al. (2000)

argue that differences in the quality of governance have led to varied growth rates in developing countries. Other empirical studies also point at the critical role of institutions for economic growth and development in developing countries (Glaeser et al., 2004; Acemoglu, & Robinson, 2008). Acemoglu et al. (2003) show that countries with weak institutions report slow growth. In particular, such countries exhibit a high degree of political instability, widespread corruption, weak protection of property rights and weak functioning markets (see also Brautigam & Knack, 2004; Acemoglu & Robinson, 2010).

According to Oyelaran-Oyeyinka (2004), strong institutions are imperative for innovation because of two reasons. First, institutions mitigate the uncertainty that surrounds innovation activities by providing regulations that govern economic agents and by enforcing contractual obligations. Secondly, institutions mediate intellectual property rights (IPRs) and patent laws that govern innovation activities. Oyelaran-Oyeyinka (2006) demonstrates that several countries in Africa adopted the industrialization model of developed countries but were less than successful at achieving technological progress due to weak institutions and inadequate human capital. Oluwatobi et al. (2014) examine the effect of institutional quality on innovation in 40 African countries. The authors suggest that control of corruption and improvement of regulatory quality result in higher rates of innovation in Africa.

The key argument in this paper is that we argue that firms will be less capable of extracting value from the resources needed to develop new innovative products depending on the functioning of institutions. Well-functioning institutions are imperative for entrepreneurial activity and innovation (Aldrich & Waldinger, 1990; Busenitz et al., 2000; Ahlstrom et al., 2003; North, 2005; Licht & Siegel, 2006; Manolova et al., 2008; Tebaldi & Elmslie, 2013). As indicated above, we include three institutions that have been reported to affect entrepreneurial

activity and innovation: corruption, rule of law and regulatory quality (cf. Chadee & Roxas, 2013). Whereas these formal institutions may not differentiate at the level of regions within a country, we argue that the actual implementation or enforcement of these institutions does vary across regions in a country, due to local experiences with corruption, the rule of law and regulatory quality (cf. Asiedu & Freeman, 2009).

## HYPOTHESES

We argue that poor regional institutional quality within a focal country makes it more difficult to extract value from a firm's resources.[2] As such, we infer that the extent to which firms can successfully use their resources for innovation is dependent on the regional institutional environment. Following this line of thought, we propose that higher regional institutional quality allows for better transformation of firm-level resources, including internal R&D, educated employees and investments in quality certification, into innovative output. We elaborate our three interaction effects below.

### *Internal R&D and regional institutional quality*

Firms in poor institutional environments are less likely to conduct and benefit from R&D (Maskus, 2000; Zhao, 2006). Governments can foster firm-level innovation by providing R&D tax incentives for firms undertaking R&D activities (Falk, 2006). Other important means refer to the establishment of science parks "combined with incentives such as free rent, low tenancy costs, favourable lease terms, and tax relief" (Gassman & Han, 2004:430). In corrupt

[2] We included internal R&D, level of education of employees and quality certification in our study. Even though we expect that these resources individually have direct effects on innovative output, we are mainly interested in how these resources interact with regional institutional quality to explain innovative output in developing countries (see McCann & Folta, 2011). As such, we do not formulate hypotheses for the main effects.

environments, a variety of transaction costs limit the scale and scope of economic activity and reduce the magnitude of the incentive for firms to invest in R&D and to be innovative (Anokhin & Schulze, 2009: 475). Corruption is believed to discourage economic activities, including innovation and entrepreneurship (Estrin et al., 2013). Moreover, elite groups may raise entry barriers that could discourage the flow of new ideas and innovations (Bardhan, 1997:1326) further reducing a firm's willingness to invest in R&D. Further, intransparant policies or legislation spurs the uncertainty firms experience, which has a negative effect on R&D investments (Gassman & Han, 2004). The rule of law plays a significant role in curbing the abuse of tax credits by firms, as well as reigning in corruption by tax officials, both of which enhance R&D spending at the firm-level (cf. Bardhan, 1997). As such, a strong rule of law will have a positive effect on firms' innovative behavior. Troilo (2011) also provides empirical evidence for this positive relation between rule of law and Schumpeterian firms. In our study we argue that the value firms can extract from their internal R&D is stronger in an environment with a high degree of regional institutional quality, which will have a positive effect on innovative output. Thus, we hypothesize that:

> H1: The level of regional of institutional quality positively moderates the effect of internal R&D on innovative output.

***Employee level of education and regional institutional quality***

Dridi (2013) suggests that corruption has a negative relation with secondary school enrolment rates. High levels of corruption result in lower levels of educational attainment that negatively impact a firm's human capital. Various empirical studies also demonstrate that corruption has a negative relation with school enrollment (Mo, 2001; Gupta et al., 2002). Moreover, a high degree of corruption is negatively associated with public education expenditure (Mauro, 1998). Africa

has experienced increasing rates of educational enrollment over the years. This is attributed to increased public education expenditure and a stronger rule of law that compels children to enroll in school (Muricho & Chang'ach, 2013). Also, it is possible that the regulatory quality environment influences the not only the rate of enrollment in schools but also the quality of education that is provided. Varsakelis (2006) argued that improving regulatory quality could lead to the adoption of a science oriented educational system, which in turn would stimulate the innovative productivity of a country. Hence, we expect that firms with well-educated employees will be more innovative, and this effect will be strengthened when regional institutional quality is high. Thus, we formulate our hypothesis as follows:

H2: The level of regional of institutional quality positively moderates the effect of level of education of employees on innovative output.

***Quality certification and regional institutional quality***

Quality certification is important for innovation. It resembles a process through which firms have build experience in providing high quality products. In addition, quality certification is an element of a technological capability that influences innovative activity in developing countries (Fagerberg & Shrolec, 2008). According to Montiel et al. (2012), corruption erodes trust in government regulation, increasing the signaling effect of quality certification for firms. Under conditions of weak rule of law and regulatory quality, firms opt for voluntary quality certification from independent auditors (Montiel et al., 2012). Obtaining quality certification requires strict adherence to laid down standards and procedures that facilitate standardization that leads to enhanced competitive advantage. Thus, regulatory pressures play a role in firms obtaining quality certification (Christmann & Taylor, 2001). Quality certification entails compliance with regulatory requirements or contractual agreements relating to a product. In

environments with high levels of government corruption and weak rule of law, it is quite likely that private auditors granting certification schemes will also be corrupt, allowing firms to only ceremonially implementing quality standards (Montiel et al., 2012). Therefore, quality certification is only likely to be more effective in regions with strong institutions. Hence, we suggest that a strong institutional environment reinforces the effect of quality certification on innovative output because firms will be more capable of extracting value from quality certification. We formulate the following hypothesis:

H3: The level of regional of institutional quality positively moderates the effect of quality certification on innovative output.

## DATA AND METHODS

### Data

We test our hypotheses using firm-level data from the World Bank Enterprise Survey (ES) and the Innovation Follow-up Survey (IFS) module covering the period 2010 to 2012 for Kenya, Tanzania and Uganda. The ES collects data focusing on an economy's business environment and investment climate encompassing, corruption, competition, access to finance and performance measures. The World Bank has conducted firm-level surveys since the 1990's, however, since 2005 data collection efforts have been centralized and instruments standardized for establishing comparability of data across countries. The IFS, launched in 2011, specifically focuses on innovation and innovation-related activities within firms. The ES involves administering firm-level surveys to a representative sample of firms in the non-agricultural formal sector in an economy comprising firms in the manufacturing and service sector. In addition, ES are stratified according to the sector of activity, firm size and geographical location of the firm. ES respondents comprise business owners and top managers from 713 firms in Kenya, 723 firms in

Tanzania and 640 firms from Uganda. Similarly, respondents for the IFS include business owners and top managers from 549 firms in Kenya, 543 firms in Kenya and 449 firms from Uganda. IFS respondents are a subset of the original ES and were randomly selected to form a sample of 75 percent of the ES respondents (www.enterprisesurveys.org). Considering that the datasets for the ES and the IFS comprise the same firms, our study merges these two datasets using the unique firm identifiers for each country to create a rich dataset for our empirical analysis.

## Dependent Variable

Our measure of the degree of innovation in firms relates to product and service innovation. Specifically, the survey asks respondents whether the firm introduced any new innovative product or service in the last three years. We use a dummy variable that takes the value of "1" if a firm has introduced either an innovative product or service and "0" if otherwise. This measure of innovation is consistent with previous research (Ayyagari et al., 2012; Chadee & Roxas, 2013).

## Independent Variables

### *Firm-level resources*

***R&D.*** The IFS asks respondents if their firm conducted internal R&D from fiscal year 2010 through 2012. To measure R&D, we use a dummy variable that takes a value of "1" if the response is yes and "0" if otherwise.

***Employee level of education.*** The ES data provides information on the level of education attained by employees. We use the percentage of employees who have completed secondary school education as a measure of the level of education attained by employees.

***Quality certification.*** The ES contains an item that asks respondents whether they have obtained any form of international quality certification. To measure quality certification, we use a dummy variable that takes a value of "1" where a firm has obtained quality certification or is in the process of obtaining certification and "0" if otherwise.

***Regional institutional quality.*** Measures of institutional quality derived from perceptions-based data are subjective and prone to measurement error. However, the availability of a large array of institutional development indicators allows the derivation of composite measures of institutional quality that are more precise (Jadhav et al., 2005). In addition, perceptions-based data have reliably reported governance outcomes in comparison to more objective measures based on formal rules (Kaufman et al., 2007). Considering that institutional quality measures tend to be highly correlated (Kaufman et al., 2011), this study uses a composite measure of firm-level perceptions of governance at the regional level for measuring regional institutional quality. This measure is constructed from regional firm-level perceptions of corruption, rule of law and regulatory quality. In addition, Kuncic (2014) argues finding a single measure of institutional quality is difficult because institutions are latent factors in an economic system. Hence the author proposes that using a composite measure combining information from several measures of institutions offers a better solution for measuring institutional quality. We use factor analysis for extracting the latent institutional factor, which represents the underlying institutional dimensions.

Following previous research, various items from the ES are used to generate a composite measure of corruption, rule of law and regulatory (Fogel, 2006; Manolova, 2008; Chadee & Roxas, 2013). We use two items for generating a composite measure of corruption. The first item asks respondents whether they perceive the court system as fair, impartial and uncorrupted with responses being measured using a four-point scale (1=strongly disagree, to 4=strongly agree).

The second item asks respondents to what degree they perceive corruption as an obstacle to the current operations of the firm. The respondents' perceptions of the degree of corruption are captured using a five-point scale (0=not an obstacle, 4=very severe obstacle). We also develop a composite measure of the rule of law using three items relate to how respondents perceive the degree to which courts, political instability and crime, theft and disorder are obstacles to their business operations and are measured using a five-point scale (0=not an obstacle, to 4=very severe obstacle). Lastly, we measure regulatory quality using a composite measure of three items. These items ask respondents to indicate on a five-point scale (0=not an obstacle, to 4=very severe obstacle) to what degree they perceive tax rates, tax administration and business permits and licensing as obstacles to their business operations. Following this, we generated means of the separate measures of institutional quality for each region. As anticipated, they correlated rather highly (correlations between 0.73 and 0.88). We therefore calculated our composite measure of institutional quality as the average of the scores for the three pillars of regional institutional quality for each region.

**Control Variables**

***Firm age.*** This study uses firm age as a control variable since previous studies support the finding that firm age is inversely related to innovative output (Hansen, 1992; Ayyagari et al., 2012). Younger firms are more likely to introduce new products and processes as compared to older firms. We use the difference between the year of the survey and the year the firm was established to compute the firm age.

***Firm size.*** This study also controls for firm size as previous studies have found a positive relation between firm size and innovation (Damanpour, 1992; Jiménez-Jiménez & Sanz-Valle, 2011; Ayyagari et al., 2012). Moreover, medium-sized (20≤employees≤99) and larger firms

(employees≥100) have been found to be more innovative in comparison to smaller firms (Ayyagari, 2012). The authors conclude that larger firms are in a position to provide economies of scale in innovation just as in production. We use the number of full-time permanent employees as our measure of firm size. We use a dummy variable to measure firm size with firms with greater than 20 employees taking a value of "1" and "0" if otherwise.

***Managerial experience.*** For our study, managerial experience is the number of years the top manager or business owner has worked in the sector. Following Ayyagari et al. (2012) we use two dummy variables for representing managerial experience, which takes a value of "1" where a business manager's experience in the sector is greater than 10 years and "0" if otherwise.

***Legal status.*** Ayyagari et al. (2012) demonstrates that ownership and legal organization play a significant role for innovation. The authors show that firms organized as corporations report greater innovation activity in comparison unincorporated forms of business (cooperatives, sole proprietorships or partnerships). The measure for legal status emanates from respondents being the asked to provide the legal organization of the firm. Legal status is a dummy variable taking the value of "1" if the firm is organized as a corporation (shareholding company with publicly traded shares and shareholding company with non-traded or privately traded shares), and "0" if the firm is legally organized as a sole proprietorship, partnership, limited partnership or has another form.

***External financing.*** The IFS module asks managers to provide estimates of the proportion of working capital financed by various sources for the previous fiscal year. Following Ayyagari et al. (2012), the different sources of external financing are expressed in percentage form. The sources of external financing include internal funds/retained earnings, banks, non-

bank financial institutions, purchases on credit from suppliers and advances from customers and other sources. We measure external financing as the percentage of working capital obtained from external sources.

***Technology licensed from a foreign-owned company.*** This variable is captured by an item in the ES that seeks to find out whether firms use technology licensed from foreign-owned companies in their operations. Following previous studies (Wang & Carayannis, 2012; Almeida & Fernandes, 2008), we expect that use of foreign technology may suppress innovation in a firm. We use a dummy variable that takes a value of "1" where a firm uses technology licensed from a foreign-owned company and "0" if otherwise

***Country dummy variables.*** This study controls for differences between countries with Kenya being the reference category.

**Analysis**

A multilevel logistic regression model is used for analyzing the data due to the binary nature of the dependent variable. Multilevel modeling is appropriate since the study employs clustered data where firms are nested within countries. Clustered data violate the assumption of independence of all observations, in this case, residuals at the firm level are expected to be correlated with the country level. Snijders & Bosker (1999) argue that multivariate multilevel models are desirable because they allow the estimation of correlation of the pairs of outcomes over the levels of analysis together with the inclusion of interaction terms in the model. Thus, the study examines innovation in firms taking into consideration the effect of the two levels. The firm (level 1 unit) and the region (level 2 unit) explain the variation in innovation in firms based on regional institutional quality. The general form of the logistic regression is:

$$Pr\,(Y_i = 1 \mid \mathrm{X}) = \frac{e^{b'_0 + b'_1 X' + b'_2 Z' + b'_3 XZ' + \varepsilon}}{1 + e^{b'_0 + b'_1 X' + b'_2 Z' + b'_3 ZX' + \varepsilon}} \quad (1)$$

Transforming equation one and formulating a 2-level model yields the following:

$$Log\left[\frac{Y}{1-Y}\right] = b_0 + b_1 X + b_2 Z + b_3 XZ + \varepsilon_{ij} \quad (2)$$

Apart from reporting on the significance and the signs of the logit coefficients (Bowen & Wiersema, 2004), it is more meaningful to examine the marginal effects of the variables and provide graphical interpretation of the interaction effects (Hoetker, 2007). In addition, we use the likelihood ratio test for fitting our final model (Long & Freese, 2006).

## RESULTS

Table 1 shows distinct variation in regional institutional quality for Kenya, Tanzania and Uganda. In particular, Kenya has better institutions in comparison to both Tanzania and Uganda. Among the three countries, Tanzania has much weaker institutions. More importantly, we observe that perceptions of institutional quality are strikingly different not only across the three countries but also within regions in these countries.

Table 2 provides the descriptive statistics and correlations for our data. We observe that 36 percent of firms in the sample have innovative output. In addition, only 21 percent of the firms conduct internal R&D. More interesting is the fact that about 60 percent of the employees have attained secondary school education. We also note that the business environment for firms operating in Kenya, Tanzania and Uganda is characterized by weak institutional quality.

Moreover, the correlation between the firm-level resources and innovation output have the expected signs.

We test our hypotheses by estimating Equation 2. The results of our estimation are summarized in Table 3, which contains five models. Model 1 is the baseline model, which contains results of the main effects of control variables, independent variables consisting of firm resources and the regional institutional quality. In addition to reporting the results of main effects of control variables and the independent variables, models 2-4 also separately report the results of the interaction effects between regional institutional quality and internal R&D, employee level education and quality certification respectively. Model 5, which offers a superior model fit in comparison to models 2-4, provides the results of the full model with main effects and interaction effects including the control variables, independent variables and the interaction of the firm-level resources and the regional institutional quality. In addition to reporting the marginal effects of the multi-level logistic regression for the full model, we also provide interaction plots for exploring the form of the interaction of firm-level resource and regional institutional quality.

Three control variables including firm size, managerial experience and use of technology licensed from a foreign-owned company are positive and statistically significant. Moreover, the likelihood of innovation for firms in Tanzania is about 24 percent lower than that of firms in Kenya. In contrast to this, the likelihood of innovation for firms in Uganda is about 13 percent higher than for firms in Kenya.

The coefficients of the independent variables including internal R&D and employee level of education are positive and significant as expected; however, the quality certification coefficient is positive but not statistically significant. Marginal effects analyses reveal that

internal R&D has a strong positive effect on innovation with the likelihood of innovation being about 23 percent higher for firms conducting internal R&D in comparison to firms that do not. Employee level of education has a very small positive effect on innovation with the likelihood of innovation being approximately 0.1 percent higher for a 1 percent increase in the number of employees with secondary school education. The context variable, regional institutional quality, is negatively significant. The likelihood of innovation is about 7 percent lower for a unit change in regional institutional quality. Consequently, regional institutional quality has a negative effect on innovative output in Kenya, Tanzania and Uganda.

An important observation regarding the coefficients of the interaction of the three firm-level resources with regional institutional quality is that they are positive and significant. These results support our hypotheses that institutions reinforce the effect of firm-level resources on innovative output. The subsequent discussion explains the interaction terms in the full model by means of margins plots. We examine the form of interaction of firm-level resources with regional institutional quality beginning with internal R&D, followed by employee level of education and quality certification respectively.

**Figure 1. Predictive margins of internal R&D**

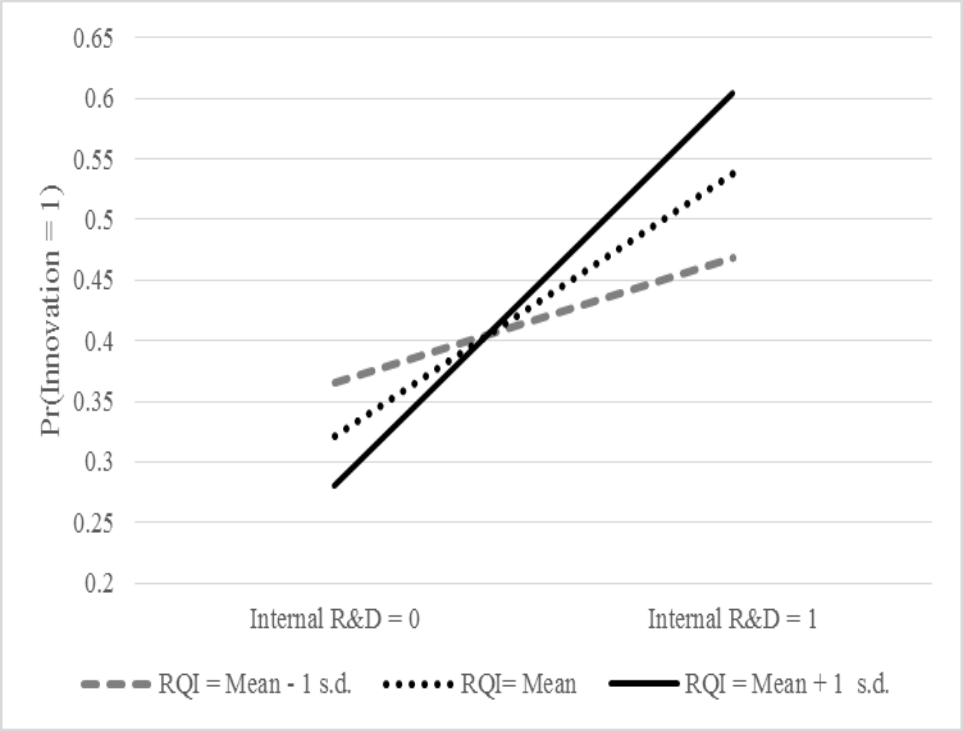


Figure 1 displays the form of the interaction of internal R&D and regional institutional quality. Indeed, the effect of conducting internal R&D varies for different levels of regional institutional quality. We observe that when regional institutional quality is low (1 standard deviation below the mean), the effect of conducting internal R&D is limited, however, with high regional institutional quality (1 standard deviation above the mean), the effect of conducting internal R&D is incomparably stronger. Thus, we see a sizable positive effect in this interaction signaling that the institutional environment within which firms operate is imperative for successful transformation of firm-level resources into innovative output. This finding is offers very strong support for hypothesis 1 where we propose that internal R&D in combination with a high degree of regional institutional quality strengthens the effect of internal R&D on innovative output.

**Figure 2. Predictive margins of employee level of education**

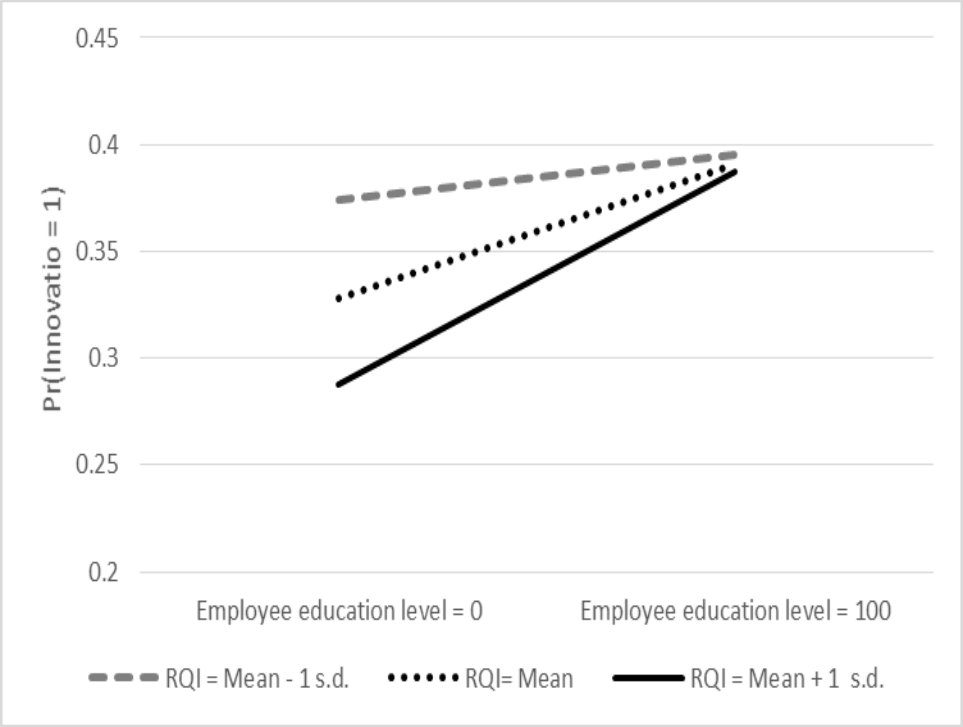


Figure 2 shows that for lower levels of regional institutional quality (1 standard deviation below the mean), the effect of employee level of education on innovative output is positive but somewhat weak. We also observe that employee level of education in an environment with a high degree of regional institutional quality (1 standard deviation above the mean) has a relatively weaker positive effect on innovative output. This is unexpected since the effect of employee level of education on innovative output is very limited in an environment with strong institutions. This result offers weak support to hypothesis 2 since the effect of education level of employees on innovative output is much weaker in the presence of strong institutions.

**Figure 3. Predictive margins of quality certification**

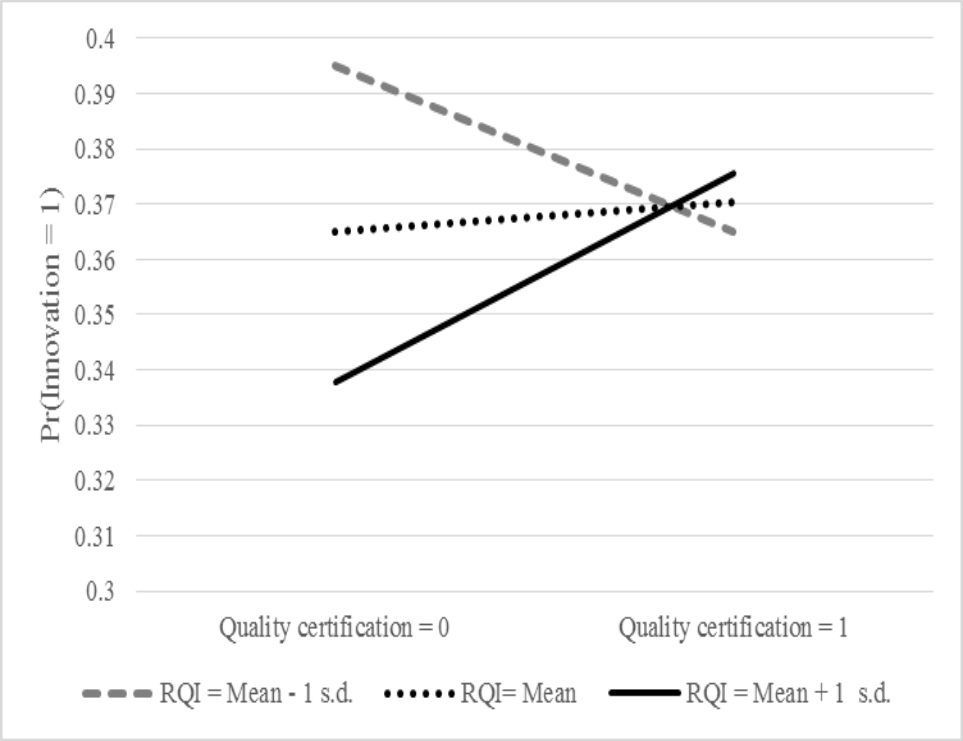


Figure 3 shows that an environment with weak institutions (1 standard deviation below the mean) diminishes the effect of quality certification on innovative output. We also note that a high degree of regional institutional quality (1 standard deviation above the mean) leads to a strong positive effect of quality certification on innovative output. This result strongly supports hypothesis 3 that strong institutions positively moderate the effect of quality certification on innovative output. Moreover, in the presence of weak institutions, quality certification may be granted without strict adherence to requirements, which negatively impacts innovative output.

## DISCUSSION

Our findings support our hypotheses to a large extent. In particular, firm-level resources including internal R&D and employee level of education have a positive and significant

association with innovative output. More importantly, the interaction of firm-level resources and regional institutional quality has a positive and statistically significant effect across all models. This implies that, while firm-level resources are pivotal for innovation, investigating the interaction of firm-level resources with regional quality institutions provides better insight into what resources matter for innovation given the institutional context within which the firms operate. Essentially, our study underscores the importance of institutions for innovation in developing countries.

We find evidence that the value of firm-level resources is conditioned on the regional institutional environment. Better institutional environments increase the value of firm-level resources for innovation while weak institutions diminish the value of firm-level resources for innovation. We argue that whilst firm-level resources are known to drive innovation, the moderation effect of institutions is imperative because institutions influence the extent to which firms extract and appropriate value from firm-level resources. Hence, the extent to which firms can successfully extract value from resources for innovation is contingent on regional institutional quality.

The moderating effect of institutions is observed even with low levels of institutional quality. We suggest that incremental improvements in institutional quality are sufficient for enhancing value extraction from firm-level resources for innovation in developing countries. We argue that larger investment in firm-level resources will not necessarily translate into more innovative output since institutions influence how firms appropriate value from their resources. Thus, innovation at the firm level not only depends on firm-level resources but also on the institutional environment in which the firm operates.

**Policy implications**

Our findings show that institutions play an important role in moderating the positive effect of firm-level resources on innovation. Regional institutional quality plays a critical role regarding the extent to which firms successfully extract value from resources into innovative output in developing countries. The value of firm-level resources for innovation significantly depends on the institutional environment from which the firms operate. In cognizance of the observed regional variation in institutional quality, it is imperative that policy makers focus on improving governance by fighting corruption, enforcing the rule of law and enhancing regulatory quality not only at the national level, but at the regional level too. Focusing on improving governance at the regional level may serve to reduce disparities in innovative output in individual countries. On the overall, strengthening the institutional environment within which businesses operate provides a sound business environment that promotes entrepreneurial activities and ultimately innovation at the firm level. As such, sound institutions serve to increase the value of firm-level resources in relation to innovative output since firms are better able to appropriate value from resources into innovative output.

Beyond the evidence put forward by our study, avenues for further research include investigating the effect of different categories of higher educational attainment on innovation, which our study does not accomplish due to unavailability of data. In addition, Mansfield (1984) opines that the composition of internal R&D expenditure is crucial to understanding how internal R&D impacts innovation in firms. As such this forms an interesting area for further research. Last but not least, given the institutional context within which the firm operates, future availability of panel data might allow researchers to examine the causal effects of firm-level resources on innovative output in developing countries.

## REFERENCES


Abed, G. T., & Gupta, S. (Eds.). (2002). *Governance, corruption, and economic performance*. International Monetary Fund.

Acemoglu, D., Johnson, S., Robinson, J., & Thaicharoen, Y. (2003). Institutional causes, macroeconomic symptoms: volatility, crises and growth. *Journal of monetary economics*, *50*(1), 49-123.

Acemoglu, D., & Robinson, J. A. (2008). Persistence of power, elites, and institutions. *American Economic Review*, *98*(1), 267-293.

Acemoglu, D., & Robinson, J. A. (2010). Why is Africa poor? *Economic history of developing regions*, *25*(1), 21-50.

Ahlstrom, D., Young, M. N., & Nair, A. (2003). Navigating China's feudal governance structures: Some guidelines for foreign enterprises. *SAM Advanced Management Journal*, *68*(1), 4-13.

Aldrich, H. E., & Waldinger, R. (1990). Ethnicity and entrepreneurship. *Annual Review of Sociology*, *16*(1), 111-135.

Almeida, R., & Fernandes, A. M. (2008). Openness and technological innovations in developing countries: evidence from firm-level surveys. *The Journal of Development Studies*, *44*(5), 701-727.

Amann, E. & Cantwell, J. (2012). Innovative firms in emerging markets countries. Oxford: Oxford University Press.

Anokhin, S., & Schulze, W. S. (2009). Entrepreneurship, innovation, and corruption. *Journal of Business Venturing*, *24*(5), 465-476.

Arundel, A., Bordoy, C., & Kanerva, M. (2007). Neglected innovators: How do innovative firms

that do not perform R&D innovate? *Results of an analysis of the Innobarometer*, 9.

Asiedu, E., & Freeman, J. (2009). The Effect of Corruption on Investment Growth: Evidence from Firms in Latin America, Sub-Saharan Africa, and Transition Countries. *Review of Development Economics*, *13*(2), 200-214.

Ayyagari, M., Demirgüç-Kunt, A., & Maksimovic, V. (2012). Firm innovation in emerging markets: The role of finance, governance, and competition. *Journal of Financial and Quantitative Analysis*, *46*(06), 1545-1580.

Bardhan, P. (1997). Corruption and development: a review of issues. *Journal of economic literature*, 1320-1346.

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, *17*(1), 99-120.

Barney, J. B. (2001). Resource-based theories of competitive advantage: A ten-year retrospective on the resource-based view. *Journal of management*, *27*(6), 643-650

Bradley, S. W., McMullen, J. S., Artz, K., & Simiyu, E. M. (2012). Capital is not enough: Innovation in developing economies. *Journal of Management Studies*, *49*(4), 684-717.

Boschma, R., & Frenken, K. (2009). Some notes on institutions in evolutionary economic geography. *Economic Geography*, *85*(2), 151-158.

Bräutigam, D. A., & Knack, S. (2004). Foreign Aid, Institutions, and Governance in Sub-Saharan Africa. *Economic development and cultural change*, *52*(2), 255-285.

Busenitz, L. W., Gómez, C., & Spencer, J. W. (2000). Country institutional profiles: Unlocking entrepreneurial phenomena. *Academy of Management Journal*, *43*(5), 994-1003.

Chadee, D., & Roxas, B. (2013). Institutional environment, innovation capacity and firm performance in Russia. *Critical Perspectives on International Business*, *9*(1), 19-39.

Christmann, P., & Taylor, G. (2001). Globalization and the environment: Determinants of firm self-regulation in China. *Journal of international business studies*, 439-458.

Chudnovsky, D., López, A., & Pupato, G. (2006). Innovation and productivity in developing countries: A study of Argentine manufacturing firms' behavior (1992–2001). *Research policy*, *35*(2), 266-288

Crespi, G., & Zuniga, P. (2011). Innovation and productivity: evidence from six Latin American countries. *World Development*, *40*(2), 273–290.

Damanpour, F. (1992). Organizational size and innovation. *Organization Studies*, *13*(3), 375-402.

De Jong, J. P., & Vermeulen, P. A. (2006). Determinants of product Innovation in small firms: A comparison across industries. *International Small Business Journal*, *24*(6), 587-609.

De Mel, S., McKenzie, D., & Woodruff, C. (2009). *Innovative firms or innovative owners? Determinants of innovation in micro, small, and medium enterprises*. Washington, D.C.: World Bank.

Dridi, M. (2013). Corruption and education: Empirical evidence. *International Journal of Economics and Financial Issues*, *4*(3), 476-493.

Estrin, S., Korosteleva, J., & Mickiewicz, T. (2013). Which institutions encourage entrepreneurial growth aspirations? *Journal of Business Venturing*, *28*(4), 564-580.

Fagerberg, J. & Srholec, M. (2008). National innovation systems, capabilities and economic development. *Research Policy*, *37*(9), 1417-1435.

Fagerberg, J., Srholec, M., & Verspagen, B. (2010). Innovation and economic development. *Handbook of the Economics of Innovation*, *2*, 833-872.

Falk, M. (2006). What drives business Research and Development (R&D) intensity across

OECD countries? Applied Economics, 38(5): 533-547.

Fischer, M. M. (2001). Innovation, knowledge creation and systems of innovation. *The Annals of Regional Science,* 35(2), 199-216.

Fogel, K., Hawk, A., Randall, M., & Yeung, B. (2006). Institutional obstacles to entrepreneurship. In M. Casson, B. Yeung, & A. Basu, *The Oxford handbook of entrepreneurship* (pp. 541-579). Oxford: Oxford University Press.

Gassman, O. & Han, Z. (2004). Motivations and barriers of foreign R&D activities in China. R&D Management, 34 (4): 423-437.

Geroski, P. A. (2000). Models of technology diffusion. *Research policy*, *29*(4), 603-625.

Glaeser, E. L., La Porta, R., Lopez-de-Silanes, F., & Shleifer, A. (2004). Do institutions cause growth? *Journal of Economic Growth*, *9*(3), 271-303.

Glynn, M. A. (1996). Innovative genius: A framework for relating individual and organizational intelligences to innovation. *Academy of Management Review, 21*(4): 1081-1111.

Goedhuys, M. (2007). Learning, product innovation, and firm heterogeneity in developing countries: Evidence from Tanzania. *Industrial and Corporate Change*, *16*(2), 269-292.

Goedhuys, M., Janz, N., & Mohnen, P. (2014). Knowledge-based productivity in "low-tech" industries: evidence from firms in developing countries. Industrial and Corporate Change, *23*(1), 1-23.

Goedhuys, M., & Sleuwaegen, L. (2010). High-growth entrepreneurial firms in Africa: A quantile regression approach. *Small Business Economics*, *34*(1), 31-51.

Gupta, S., Verhoeven, M., & Tiongson, E. R. (2002). The effectiveness of government spending on education and health care in developing and transition economies. *European Journal of Political Economy*, *18*(4), 717-737.

Hansen, J. A. (1992). Innovation, firm size, and firm age. *Small Business Economics*, *4*(1), 37-44.

Hoang, D. T., Igel, B., & Laosirihongthong, T. (2006). The impact of total quality management on innovation: Findings from a developing country. *International journal of quality & reliability management*, *23*(9), 1092-1117.

Hoetker, G. (2007). The use of logit and probit models in strategic management research: Critical issues. *Strategic Management Journal*, *28*(4), 331-343.

Jadhav, N., Ranjan, R. & Hajra, S. (2005). *Re-emerging India- A global perspective*. India: ICFAI University Press

Jiménez-Jiménez, D., & Sanz-Valle, R. (2011). Innovation, organizational learning, and performance. *Journal of Business Research*, *64*(4), 408-417.

Kamau, P., & Munandi, I. (2009). Innovation in the Kenyan clothing sector and its impact on employment and poverty reduction. *Available on line: acfrn. uonbi. ac. ke/.../innovation% 20in% 20Kenya.(February 25, 2013)*.

Kanji, G. K. (1996). Can total quality management help innovation? *Total Quality Management*, *7*(1), 3-10.

Kaufmann, D., Kraay, A., & Mastruzzi, M. (2007). *The worldwide governance indicators project: answering the critics* (Vol. 4149). World Bank Publications.

Kaufmann, D., Kraay, A., & Mastruzzi, M. (2011). The worldwide governance indicators: methodology and analytical issues. *Hague Journal on the Rule of Law*, *3*(02), 220-246.

Kim, L., & Nelson, R. R. (2000). *Technology, learning, and innovation: Experiences of newly industrializing economies*. Cambridge University Press.

Kuncic, A. (2014). Institutional quality dataset. *Journal of Institutional Economics*, *10*(01), 135-161.

Laursen, K., Masciarelli, F., & Prencipe, A. (2012). Regions matter: how localized social capital affects innovation and external knowledge acquisition.*Organization Science, 23*(1), 177-193.

Lee, K., & Kang, S.-M. (2007). Innovation Types and Productivity Growth: Evidence from Korean

Manufacturing Firms. Global Economic Review, *36*(4), 343–359.

Levin, R. C., Klevorick, A. K., Nelson, R. R., Winter, S. G., Gilbert, R., & Griliches, Z. (1987). Appropriating the returns from industrial research and development. *Brookings papers on economic activity*, 783-831.

Licht, A. N., & Siegel, J. I. (2006). The social dimensions of entrepreneurship. *Oxford handbook of entrepreneurship*, 511-39.

Long, J. S., & Freese, J. (2006). *Regression models for categorical dependent variables using Stata*. College Station, TX: Stata Press.

Lorente, A. R. M., Dewhurst, F., & Dale, B. G. (1999). Total quality management and business innovation. *European Journal of Innovation Management*, *2*(1), 12-19.

Manolova, T. S., Eunni, R. V., & Gyoshev, B. S. (2008). Institutional environments for entrepreneurship: Evidence from emerging economies in Eastern Europe. *Entrepreneurship Theory and Practice*, *32*(1), 203-218.

Mansfield, E. (1984). R&D and innovation: some empirical findings. In *R & D, Patents, and Productivity* (pp. 127-154). University of Chicago Press.

Martin-de Castro, G. M, Delgado-Verde, M., Navas-López, J. E., & Cruz-González, J. (2013). The moderating role of innovation culture in the relationship between knowledge assets and product innovation. *Technological Forecasting and Social Change*, *80*(2), 351-363.

Maskus, K. E. (2000). Intellectual property rights in the global economy. Institute for International Economics. Washington, DC.

Mauro, P. (1998). Corruption and the composition of government expenditure. *Journal of Public economics*, *69*(2), 263-279.

McAdam, R., Reid, R., & Shevlin, M. (2014). Determinants for innovation implementation at SME and inter SME levels within peripheral regions. *International Journal of Entrepreneurial Behaviour & Research*, *20*(1), 66-90.

McCann, B. T., & Folta, T. B. (2011). Performance differentials within geographic clusters. *Journal of BusinessVenturing*, *26*(1), 104-123.

McGuirk, H., & Lenihan, H. (2013). Innovation and Human capital: The impact of firm and regional factors on Innovative Human Capital. Retrieved from http://www.isbe.org.uk/content/assets/Networks_Helen_McGuirk.pdf

Meyer, K.E., Estrin, S., Bhaumik, S.K. & Peng, M.W. (2009). Institutions, resources and entry strategies in emerging economies. Strategic Management Journal, 30: 61-80).

Mo, P. H. (2001). Corruption and economic growth. *Journal of Comparative Economics*, *29*(1), 66-79.

Montiel, I., Husted, B. W., & Christmann, P. (2012). Using private management standard certification to reduce information asymmetries in corrupt environments. *Strategic Management Journal*, *33*(9), 1103-1113

Muricho, W., & Chang'ach, J. (2013). Education reforms in Kenya for innovation. *International Journal of Humanities and Social Science*, *9*, 123-145.

North, D. C. (1990). *Institutions, institutional change, and economic performance*. Cambridge: Cambridge University Press.

North, D. C. (2005). Institutions and the process of economic change. *Management International*, *9*(3), 1-7.

Olson Jr, M., Sarna, N., & Swamy, A. V. (2000). Governance and growth: A simple hypothesis explaining cross-country differences in productivity growth. *Public Choice*, *102*(3-4), 341-364.

Oluwatobi, S., Efobi, U., Olurinola, I., & Alege, P. (2014). Innovation in Africa: Why Institutions Matter. *South African Journal of Economics*.

*Oslo manual: guidelines for collecting and interpreting innovation data.* (3rd ed.). (2005). Paris: Organization for Economic Co-operation and Development.

Oyelaran-Oyeyinka, B. (2004). How can Africa benefit from globalization?: Global governance of technological and Africa's global exclusion. Retrieved from http://www.atpsnet.org/Files/special_paper_series_17.pdf

Oyelaran-Oyeyinka, B. (2006). Systems of innovation and underdevelopment an institutional perspective. *Science Technology & Society*, *11*(2), 239-269.

Pekovic, S., & Galia, F. (2009). From quality to innovation: Evidence from two French employer surveys. *Technovation*, *29*(12), 829-842.

Peteraf, M. A. (1993). The cornerstones of competitive advantage: A resource-based view. *Strategic management journal*, *14*(3), 179-191.

Picard, L., Silverman, J., Vogelsang, S., Walter, B., & Kogul, M. (2006). Regional variation in local governance. Retrieved from http://pdf.usaid.gov/pdf_docs/PNADJ271.pdf

Robson, P. J., Haugh, H. M., & Obeng, B. A. (2009). Entrepreneurship and innovation in Ghana: enterprising Africa. *Small Business Economics*, *32*(3), 331-350.

Roffe, I. (1999). Innovation and creativity in organizations: a review of the implications for training and development. *Journal of European Industrial Training*, *23*(4/5), 224-241.

Rothwell, R. & Zegveld, W. (1982). *Innovation and the small and medium sized firm their role in employment and in economic change*. London: Frances Pinter Publishers.

Sanz Cañada, J., & Macías Vázquez, A. (2005). Quality certification, institutions and innovation in local agro-food systems: protected designations of origin of olive oil in Spain. *Journal of Rural Studies*, *21*(4), 475-486.

Schumpeter, J. A. (1934). *The theory of economic development: an inquiry into profits, capital, credit, interest, and the business cycle (Vol.55)*. New Jersey: Transaction Publishers.

Shi, W. S., Sun, S. L., & Peng, M. W. (2012). Sub-National Institutional Contingencies, Network Positions, and IJV Partner Selection. *Journal of Management Studies*, *49*(7), 1221-1245.

Sirmon, D.G., Hitt, M.A. & Ireland, R.D. (2007). Managing firm resources in dynamic environments to create value: looking inside the black box. Academy of Management Review, 32(1): 273-292.

Snijders, T. A. B. & Bosker, R. J. (1999). Multilevel analysis: An introduction to basic and advanced multilevel modeling. London: Sage.

Srholec, M. (2011). A multilevel analysis of innovation in developing countries. *Industrial and Corporate Change*, *20*(6), 1539-1569.

Tebaldi, E., & Elmslie, B. (2013). Does institutional quality impact innovation? Evidence from cross-country patent grant data. *Applied Economics*, *45*(7), 887-900.

Troilo, M. (2011). Legal institutions and high-growth aspiration entrepreneurship. *Economic Systems*, *35*(2), 158-175.

Tybout, J. (2000). Manufacturing firms in developing countries: How well do they do, and why?

Journal of Economic Literature, *38*(March): 11-44.

Varsakelis, N. C. (2006). Education, political institutions and innovative activity. A cross-country empirical investigation. *Research Policy*, *35*(7), 1083-1090.

Wang, V., & Carayannis, E. G. (2012). *Promoting balanced competitiveness strategies of firms in developing countries* (Vol. 12). Springer.

Zhao, M. (2006). Conducting R&D in countries with weak intellectual property rights protection. Management Science, 52(8): 1185-1199.

**Table 1. Regional institutional quality**

| Country | Region | Regulatory Quality | Rule of Law | Corruption | Regional Institutional Quality |
|---|---|---|---|---|---|
| Kenya | Central | 0.49 | 0.21 | 0.19 | 0.30 |
| | Nyanza | 0.39 | 0.13 | 0.31 | 0.28 |
| | Mombasa | 0.37 | 0.31 | 0.23 | 0.30 |
| | Nairobi | 0.32 | 0.21 | 0.17 | 0.23 |
| | Nakuru | 0.45 | 0.29 | 0.44 | 0.40 |
| Tanzania | Arusha | -0.01 | 0.03 | 0.21 | 0.07 |
| | Dar-es-Salaam | -0.51 | -0.37 | -0.49 | -0.46 |
| | Mbeya | 0.20 | 0.54 | 0.59 | 0.45 |
| | Mwanza | -0.09 | -0.41 | -0.37 | -0.29 |
| | Zanzibar | -0.76 | -0.40 | -0.70 | -0.62 |
| Uganda | Kampala | -0.22 | 0.13 | 0.17 | 0.03 |
| | Jinja | 0.04 | -0.21 | -0.31 | -0.16 |
| | Lira | 0.07 | -0.24 | -0.28 | -0.15 |
| | Mbale | 0.52 | 0.27 | 0.28 | 0.35 |
| | Mbarara | 0.04 | -0.26 | 0.19 | -0.01 |
| | Wakiso | -0.16 | -0.04 | 0.11 | -0.03 |

**Table 2. Descriptive statistics and correlation matrix (n = 1541)**

| | | Mean | Std. Dev. | Min | Max | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Innovation | 0.36 | 0.48 | 0 | 1 | - | | | | | | | | | | | |
| 2 | Age (ln) | 2.58 | 0.79 | 0 | 4.67 | 0.01 | - | | | | | | | | | | |
| 3 | Size (ln) | 2.84 | 1.31 | 0 | 8.61 | 0.11 | 0.23 | - | | | | | | | | | |
| 4 | Managerial experience | 0.62 | 0.49 | 0 | 1 | 0.06 | 0.41 | 0.18 | - | | | | | | | | |
| 5 | Legal status | 0.10 | 0.31 | 0 | 1 | 0.09 | 0.13 | 0.15 | 0.08 | - | | | | | | | |
| 6 | External financing | 30.08 | 32.04 | 0 | 100 | 0.04 | 0.07 | 0.07 | 0.01 | 0.09 | - | | | | | | |
| 7 | Foreign technology licensing | 0.09 | 0.29 | 0 | 1 | 0.13 | 0.13 | 0.21 | 0.06 | 0.12 | 0.08 | - | | | | | |
| 8 | Tanzania | 0.35 | 0.48 | 0 | 1 | -0.31 | -0.07 | -0.04 | -0.04 | -0.13 | -0.11 | -0.15 | - | | | | |
| 9 | Uganda | 0.29 | 0.45 | 0 | 1 | 0.22 | -0.14 | -0.13 | -0.09 | -0.03 | -0.09 | 0.07 | -0.47 | - | | | |
| 10 | Internal R&D | 0.21 | 0.41 | 0 | 1 | 0.19 | 0.07 | 0.15 | 0.11 | 0.03 | 0.06 | 0.08 | 0.03 | -0.10 | - | | |
| 11 | Employee level of education | 59.81 | 34.83 | 0 | 100 | 0.10 | 0.05 | 0.18 | 0.08 | 0.08 | -0.03 | 0.06 | -0.22 | -0.16 | 0.06 | - | |
| 12 | Quality certification | 0.26 | 0.44 | 0 | 1 | 0.06 | 0.15 | 0.37 | 0.06 | 0.12 | 0.11 | 0.18 | -0.02 | -0.05 | 0.10 | 0.11 | - |
| 13 | Regional institutional quality | 0.00 | 0.32 | -0.62 | 0.45 | 0.14 | 0.08 | 0.05 | -0.01 | 0.11 | 0.09 | 0.10 | -0.66 | 0.01 | -0.09 | 0.22 | 0.00 |

**Table 3. Multivariate logistic regression coefficients for innovation, firm-level resources and regional institutional quality (n = 1541)**

| **Variables** | Model 1 | | Model 2 | | Model 3 | | Model 4 | | Model 5 | |
|---|---|---|---|---|---|---|---|---|---|---|
| ***Control variables*** | | | | | | | | | | |
| Age (log) | -0.130 | (0.105) | -0.125 | (0.105) | -0.126 | (0.105) | -0.136 | (0.105) | -0.127 | (0.105) |
| Size (log) | 0.127* | (0.068) | 0.120* | (0.070) | 0.127* | (0.067) | 0.132** | (0.067) | 0.123* | (0.069) |
| Managerial experience | 0.176* | (0.094) | 0.174* | (0.093) | 0.169* | (0.094) | 0.174* | (0.096) | 0.166* | (0.094) |
| Legal status | 0.279 | (0.256) | 0.282 | (0.263) | 0.279 | (0.256) | 0.268 | (0.254) | 0.274 | (0.260) |
| External financing | 0.001 | (0.002) | 0.001 | (0.002) | 0.001 | (0.002) | 0.001 | (0.002) | 0.002 | (0.002) |
| Foreign technology licensing | 0.358** | (0.160) | 0.318* | (0.169) | 0.366** | (0.159) | 0.339** | (0.162) | 0.309* | (0.172) |
| Tanzania | -1.383*** | (0.423) | -1.351*** | (0.465) | -1.309*** | (0.439) | -1.340*** | (0.434) | -1.240** | (0.491) |
| Uganda | 0.659** | (0.265) | 0.628** | (0.285) | 0.718*** | (0.269) | 0.676** | (0.269) | 0.705** | (0.293) |
| ***Resources and institutions*** | | | | | | | | | | |
| Internal R&D | 1.048*** | (0.305) | 1.060*** | (0.169) | 1.037*** | (0.309) | 1.049*** | (0.307) | 1.051*** | (0.170) |
| Employee level of education | 0.004** | (0.002) | 0.003** | (0.002) | 0.004** | (0.001) | 0.004** | (0.002) | 0.003** | (0.001) |
| Quality certification | 0.040 | (0.144) | 0.045 | (0.144) | 0.043 | (0.145) | 0.011 | (0.144) | 0.028 | (0.143) |
| Regional institutional quality | -0.364 | (0.539) | -0.861 | (0.657) | -0.680 | (0.537) | -0.480 | (0.547) | -1.287* | (0.661) |
| ***Interactions*** | | | | | | | | | | |
| Internal R&D*RIQ (H1) | | | 1.744*** | (0.527) | | | | | 1.745*** | (0.527) |
| Employee level of education*RIQ (H2) | | | | | 0.007** | (0.003) | | | 0.007** | (0.003) |
| Quality certification*RIQ (H3) | | | | | | | 0.622** | (0.295) | 0.554* | (0.323) |
| Constant | -1.080*** | (0.307) | -1.009*** | (0.318) | -1.138*** | (0.281) | -1.093*** | (0.304) | -1.086*** | (0.301) |
| LR Chi2 | | | 15.990 | | 1.160 | | 1.870 | | 18.860 | |
| Prob>chi2 | | | 0.000 | | 0.281 | | 0.171 | | 0.000 | |

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

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