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Financial Access and Informal Competition as Drivers of Firm-Level Innovation in African countries: Evidence from Uganda

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Abstract:

The study aims to identify the main determinants of innovation among variables that theoretically have a direct impact on it. Applying a binary logistic regression model to the BEEPS datasets for Uganda, the empirical results indicate that R&D expenditures are the strongest drivers of both product and process innovation. Product innovation is positively influenced by managerial ownership retail sector activity, competitive pressure from informal firms, and complementarity with process innovation. However, Process innovation is significantly associated with firm age, foreign technology licensing, fixed asset investment, energy management adoption, access to finance, and competition. Descriptive findings indicate that innovation in Uganda is mainly incremental and market-driven. The study highlights the importance of strengthening technological capabilities, financial access, and institutional support to foster sustainable innovation-led growth.

Keywords: process innovation, product innovation, Uganda, determinants, logit regression model
Jel code : O55, O31, L11, L25.

Introduction:

Innovation is widely recognized as a central driver of economic growth, productivity, and structural transformation. Since the seminal contribution of joseph Schumpeter, innovation has been understood as the introduction of new combinations- new products, new process, new markets, and new organizational forms- that drive creative destruction and economic development (J. Schumpeter, 1934; J. A. Schumpeter & Swedberg, 1942). Contemporary definitions, particularly those advanced in the OECD Oslo manual, conceptualize innovation as the implementation of new or significantly improved product and business process (OECD & Eurostat, 2018).

The determinants of innovation have been extensively studied across developed and emerging economies. From the perspective of Resource-Based view (Barney, 1991), firms innovate when they possess valuable, rare, and inimitable resources. Similarly, the national innovation systems approach emphasizes the role of institutional environment, financial systems, and knowledge networks in shaping firm-level innovation performance (Malerba, 2002) . Empirical studies highlight the importance of R&D investment, firms' size, age, managerial characteristics, technological acquisition, and competitive pressure (Aghion et al., 2005; Huergo &

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Jaumandreu, 2004). However, evidence from Sub-saharan Africa remain relatively limited, particularly at the firm level. In many African economies, innovation tends to be incremental, adaptive, and market-driven rather radical or science-based. Uganda a particularly relevant context. The country has increasingly integrated science, technology, and innovation into its vision 2040 and national development plans, yes SMEs continue to operate in environments characterized by financial constraints, informality, and limited technological infrastructure.

This paper contributes to the literature in three ways. First, it provides firm-level empirical evidence on innovation determinants in Uganda using logistic regression analysis. Second, it distinguishes between product and process innovation, allowing for differentiated insights. Third, it integrates managerial, technological, environmental and competitive variables within a unified analytical framework.

The paper is organized as follows:

After this introduction, literature review that contain theoretical presentation of all of innovation and different types of innovation, main determinants of innovation, next empirical part that contains three sections, the first is about the reality of innovation in UGANDA, next the presentation of the methodology of the empirical part and presentation of variables of the study, and third section is about the presentation of data and discussion. Finally, the paper will be finished with conclusion and recommendation.

1 Literature review:

Following the great importance of innovation, and its relation to all sectors and fields, different variables and characteristics influence it. The variables of the study are regrouped into three categories that are: organizational characteristics, managerial characteristics and technological characteristics.

1.1 Innovation: types and definitions

1.1.1 Evolution of innovation definitions:

Across history, the meaning of innovation has shifted from a political suspect change to a multi-dimensional driver of economic and social transformation. Before the 18th century, the latin word innovo referred to introducing changes in law or religion(Benoît Godin, 2019). Between 19th to early 20th century, innovation take the meaning of progress and desirable societal change(Oki, 2019). From the early 20th century to the mid-20th century, Schumpeter framed innovation as new combination in product (new product, process, markets and organizations) driving creative destruction and growth(Kogabayev & Maziliauskas, 2017). Late 20th century: the definition of innovation expanded from a product to process , from idea to commercialization, integrating science, technology, markets and management and emphasizing value creation and profitability (Kogabayev & Maziliauskas, 2017). 21st century: innovation is now treated as a learning-based, interactional and social process, including organizational, service, and social innovation oriented to structural and sustainable change(Maldonado-Mariscal & Alijew, 2023).

1.1.2 Types of innovation:

There are different classifications of innovation. Basing on Henderson-Clark model, he gives three classifications of innovation basing on the impact of the changes that are incremental, radical, disruptive or architectural(Kaine & Higson, 2006). There is also modern and systemic types here the authors separate between open innovation, social innovation, sustainable innovation and frugal innovation(Mariani et al., 2023).

However, in this paper , we based on the types presented by OECD in 2018. According to (Kunttu et al., 2021; OECD & Eurostat, 2018), there are two main types of innovation that are:

Product innovation: introducing a new or significantly improved good or service.

Business process innovation: implementing a new or significantly improved process with the firm, covering areas such as production, distribution, marketing and administration.

1.2 Determinants of innovation:

there are many variables that could have direct or indirect relationship between the innovation. There are variables that represents the characteristics of the firms such as age of the firms, sector of activity, size of the firms, and others.

1.2.1 Age of the firm:

Age of the firms play different roles with ability to innovate. New firms with new ideas some times are able to innovate more than old firms because old firms don't like to change and take the risks to change, and this ability decline with the advanced ages (Huergo & Jaumandreu, 2004). Sometimes, old firms are more capable to innovate more than the young firms because the old firms accumulate more information's and more knowledge about the market, competitors, new technologies that it allows it to innovate more than others and the rate of the risk will be small comparing with the new firms that don't have any information about the components of the market (Bourouaha & Maliki, 2021b; Yin et al., 2022).

1.2.2 Size of the firm:

Different studies find that size of the firms has link with different types of innovation (Bourouaha & Maliki, 2021b). The relationship between firm size and innovation has been one of the central debates in industrial economics since Schumpeter. Schumpeter in his books "the theory of economic development, 1934" and "Capitalism, Socialism and Democracy,1942". At first, Schumpeter said that innovation is driven by small and new firms, which are more flexible, entrepreneurial and willing to take risks(J. Schumpeter, 1934). In the second book, he mentioned that innovation is dominated by large firms, which benefit from economies of cale, financial resources, and stable R&D laboratories (J. A. Schumpeter & Swedberg, 1942). According to the resource-based view, firms size matters because larger firms have greater financial resources, more specialize human capital, better access to external finance in addition to stronger organizational routines. These advantages increase the capacity of the firm to invest in R&D and to manage innovation projects.

1.2.3 Sector of activity:

The link between sector of activity of the firm and innovation is complex. Innovation is sector specific by nature because industries differ in technological opportunities, knowledge bases, appropriability conditions, production processes and market dynamics. This idea originates from Schumpeterian economics, which emphasizes that innovation depend on the technological and institutional environment in which firms operate (J. A. Schumpeter & Swedberg, 1942). Later, evolutionary and neo-Schumpeterian scholars formalized this idea by showing that innovation patters vary systematically across sectors, leading to persistent differences in innovation intensity and type. According to (Malerba, 2002), each sector is characterized by a specific knowledge base, a distinct learning processus, different actors and institutions and particular technological regimes. Therefore, manufacturing sectors tend to exhibit higher levels of product and process innovation due to structured R&D, engineering capabilities and cumulative.

1.2.4 Characteristics of top manager:

From the human capital theory, a top manager's experience is a crucial , accumulated knowledge skills, abilities, and judgement developed through years in their sector often measured by years in the industry, that enhances decision-making, drives innovation and creates firms value, acting as both general (transferable) and specific (industry-focused) capital essential for competitive advantage(Timothy, 2022). Top manager with more years of experience have more ability to innovate rather than top managers with less number years of experiences, because years of experience represent cumulative knowledge capacity to take decision (Okrah & Irene, 2023; Timothy, 2022)

Gender of top manager can shape innovation mainly by changing leadership style, team composition, risk preferences and diversity of perspectives. In developing countries, firms with female top manager are more likely to innovate in both product and process innovation than those led by men (Na et al., 2019; Ritter-Hayashi et al., 2019).

Also, there is another factor related with the manager and has an important effect on the performance or the innovativeness of the firms, that is the firm ownership. Ownership of the firm refers to how equity and control rights are distributed among families, founders, managers, institutions, the state, and dispersed public shareholders. Research shows that who owns a firm strongly influences performance, governance, investment and risk (Federo et al., 2020; Solarino & Boyd, 2020). Concerning innovation, the firm ownership hurts innovation because it the owners invest less in R&D or training due to conflicts or to do not take new risks (Minetti et al., 2015)

1.2.5 Formal Training:

Formal training is defined as a highly structured, intentional and regulated educational process occurring within a planned setting (Trentin, 2009). Training can significantly boost innovation at different levels that are individual, team and firm levels(Bourouaha & Maliki, 2021a). But these effects depend on design, context and follow-through. The training can influence innovation in different faces, training builds skills of trainees and human capital(Dostie, 2018; Mwadzingeni et al., 2025; Na, 2021). Also, it strengthens creative behavior and innovative capabilities(Nardo & Aprilyani, 2024; Nekoye et al., 2025; Romain & Agogué, 2021). Moreover, the training of employees Shape culture, learning climate and commitment(Sung & Choi, 2014; Valenzuela-Muñoz et al., 2024).

1.2.6 Research and development:

Research and development R&D are defined as systematic, creative work aimed at increasing the stock of knowledge to devise new applications. R&D is the primary driver of innovation, acting as the foundation for creating new products, processes and businesses models(OECD, 2015) . For an activity to be classified as R&D, it must meet five specific core criteria. If any of these are missing, the activity is generally considered "routine" or "industrial" rather than true R&D:

Novelty: it must be aimed at new findings.

Creativity: it must be based on original, non-obvious concepts and hypotheses

Uncertainty: there must be uncertainty about the final outcome or the time and resources needed to achieve it.

Systematic: it must be planned and budgeted and documented.

Transferable/Reproducible: it must lead to results that can be reproduced or knowledge that can be shared.

1.2.7 Foreign technology licensing:

Foreign technology licensing or international technology licensing is defined as a contractual arrangement in which a firm in one country (the licensor) grant a firms in another country (the licensee) the legal right to utilize its proprietary technology in exchange for compensation(Atuahene-Gima, 1993). Foreign technology licensing can strongly support innovation, especially in developing/emerging economies, but its impact depends on absorptive capacity, complementary R&D and industry/technology context. According to (Musandiwa & Ngwakwe, 2020), licensing foreign technology is positively and significantly related to new product innovation.

1.2.8 Adoption of energy management measures:

Adoption of energy management measures involves a systematic process of monitoring , analyzing, and improving energy use through strategies like upgrading equipment, behavioral changes, and implementing systems like ISO 50001 (ISO 50001 from the measures of energy management systems that require firms to systematically monitor, measure, and improve energy performance) or smart home tech to reduce costs, boost efficiency and meet sustainability goals, driven by financial benefits, environmental responsibility and policy (Nwarueze et al., 2025). According to the study of Marimon and Casadesus, the adoption of ISO 50001 improves operational processes (example: energy tracking, performance evaluation) which can create space and incentives fir firms to explore technological and managerial innovations that reduce consumption and costs(Marimon & Casadesús, 2017).

1.2.9 Competition:

Competition is defined as the introduction on the market as a situation where at least two actors, constrained by shared rules, strive to outperform one another in order to obtain scarce, rival good or advantage(Altreiter et al., 2025; Vidican & Hepeș, 2023). Competition is the core of the success or failure of firms, determining the appropriateness of a firm's activities that can contribute to its performance , such as innovation, cost leadership or differentiation (Porter, 1985). Following the study of (Canare & Francisco, 2021), there is a positive association between competition and innovation by forcing the firms to look for new methods of marketing , procedures and innovate new product and services to face the new competitors and survive for a long period of time. According to (Aghion et al., 2005), Competitive pressure compels firms to innovate in order to survive and maintain market position. In the other hand of the competition, many multi-country studies find a positive association: exposure to informal competitors increases the likelihood that formal firms engage in product, process, and R&D innovation(Amin, 2025; Hlioui et al., 2022).

2 Empirical part :

2.1 Overview about innovation in Uganda:

According to the study of (Bourouaha & Maliki, 2018), the African countries follow the developed countries in the subject of innovate. Uganda's strategy is less about copying rich countries and more about building its own path using science, technology and its comparative advantages to close development gaps. Innovation in Uganda remains emergent and constrained by structural, institutional and resource challenges. According to the global innovation index 2024, Uganda ranked 121st out of 133 economies, reflecting low overall innovation performance, particularly in research, infrastructure, and business sophistication indicators. While Uganda scores higher in innovation outputs than inputs, its overall score 14,9 remains relatively low

compared with regional peers, highlighting systemic gaps in the innovation ecosystem.

Research and development investment in Uganda has historically been low. Government data indicate R&D expenditure at approximately 0.4% of GDP, with business R&D spending virtually negligible.

This limited investment in R&D constraints the generation and diffusion of new knowledge, a key driver of technological capability and productivity growth as emphasized in innovation system literature (OECD, 2018).

Policy efforts have increasingly integrated science, technology, and innovation STI into national development strategies, particularly under Uganda's vision 2040 and national development plans (Jjagwe et al., 2024). However, studies highlight persistent challenges, including weak university-industry linkages, limited commercialization mechanisms, financial constraints, and a fragmented innovation system (Kamunyori et al., 2010; Malerba, 2002).

At the form level, innovation is predominantly incremental and market-driven especially in agro-processing, manufacturing and services rather than science-based or radical. Overall, strengthening R&D investment, institutional coordination, and absorptive capacity remains to enhance Uganda's innovation performance and competitiveness.

2.2 Variables of the study:

The variables of the study are presented in the tables bellow:

Variable	Nature	Categories
Size	Ordinal	Small, medium, large
Sector	Nominal	Manufacturing, retailing, other services
Age of the firm	Scall	Open variable (quantitative variable)
Using foreign owned technology license	Binary	Yes, no
Formal training program	Binary	Yes, no
Purchasing fixed assets	Binary	Yes, no
Top manager owns the firm	Binary	Yes, no
Top manager is female	Binary	Yes, no
Experience of top manager	Scall	Quantitative variable
R&D expenditures	Binary	Yes, no
Competition against informal competitors	Binary	Yes, no
having a loan from a financial institution	Binary	Yes, no
Product innovation	Binary	Yes, no
Process innovation	Binary	Yes, no
adoption energy management measures	Binary	Yes, no

Source: authors elaboration

2.3 Estimation strategy:

To achieve the main objectives of the study, quantitative analytical techniques where employes. First, descriptive analysis was conducted to give the distribution and he frequencies of the modalities of each variable of the study. In the second step, binary logistic regression was applied to identify the determinants

of innovation. Logistic regression allows for the estimation of the effect of one or more independent variables on a dichotomous dependent variable. The dependent variables is measured as a binary outcome, while the independent variables may be continuous, categorical, or a combination of both. This method estimates the coefficient , along with their standard errors and significance levels, in order to predict the logit transformation of the probability of the occurrence of the event of interest (Hadi Farid et al., 2010):

Let the dependent variable $Y_i = \begin{cases} 1 \ if \ the \ firm \ is \ innovative \\ 0 \ otherwise \end{cases}$

The probability that firm i is innovative is defined as:

$$P(Y_i = 1|X_i) = p_i$$

$$logit(p_i) = \beta_0 + \beta_1 X_{1i} + \beta_1 X_{1i} + \ \beta_1 X_{1i} + \cdots + \ \beta_1 X_{1i_i}$$

p_i: the probability of the presence of the characteristic of interest

The logit transformation is defined as the logged odds: $odds = \frac{Pi}{1-Pi}$

The logit of the unknown binomial probabilities is modelled as a linear function of X_i:

$$logit(p_i) = Ln\left(\frac{Pi}{1-Pi}\right) = \beta_0 + \sum_{j=1}^{n} \beta_j X_{ji}$$

The logit model assumes that underlying stimulus index logit(pi) is a random variable, that predicts the probability of innovation adoption (product innovation, process innovation).

The logit model will be expressed as:

$$product\ innovation_i = \beta_0 + \beta_1 exp_i + \beta_2 gnd_i + \beta_3 own_i + \beta_4 age_i + \beta_5 size_i + \beta_6 sct_i + \beta_8 trn_i + \beta_{10} FOT_i + \beta_{11} RD_i + \beta_{12} PFE_i + \beta_{13} ENM_i + \beta_{14} INC_i + \beta_{14} IPS_i + \beta_1 fin_i$$

2.4 Characteristics of the firm:

The table below presents the distribution of the sample according to firm size of the firm and sector of activity. This classification provides an overview of the structural composition of the surveyed firms and allows for a better understanding of the economic context in which innovation activities occur

Table 1: Sampling Size and sector of activity of the sample

Sampling size of the firm			sector of activity		
Modalities	Frequency	%	Modalities	Frequency	%
Small	239	39,5	Manufacturing	217	35,9
Medium	240	39,7	Retailing	149	24,6
Large	126	20,8	services	239	39,5
Total	605	100,0	Total	605	100,0

Source: author's elaboration using BEEPs datasets of Uganda

Table 1 presents the distribution of firms by size and sector of activity. Regarding firm size, the sample is relatively balanced between small (39,5%) and medium-sized enterprises (39,7%), while large firms represent 20,8% of the total.

This indicates that the dataset is largely composed of SMEs, with a smaller proposition of large establishment. In term of sectoral distribution, services account for the largest share (39,5% followed by manufacturing 35,9% and retailing in the third place with 24,6%. The sample therefore reflect a diversified structure, with a slight dominance of service-oriented firms.

Table 2: Descriptive Distribution of the Sampled Firms in Uganda

Reponses	Yes		No		Total
Variables	N	%	N	%	N
offering formal training programs for permanent full-time employees	179	29,6	426	70,4	605
Using technology licensed from a foreign owned company	90	14,9	515	85,1	605
R&D expenditures	61	10,1	544	89,9	605
The Establishment Purchase Any Fixed Assets	139	23,5	466	76,5	605
the firm has a loan from a financial institution	139	23,0	466	77,0	605
establishment adopt energy management measures?	319	52,7	286	47,3	605
establishment monitor its CO2 emissions?	186	30,7	419	69,3	605
Competition Against Unregistered or Informal Firms	408	67,4	197	32,6	605
Top manager is the owner of the firm	484	80,0	121	20,0	605
Is The Top Manager a Woman	123	20,3	482	79,7	605
the firm has a loan from a financial institution	139	23,0	466	77,0	605
Product innovation	159	26,3	446	73,7	605
Product innovation for the main market	97	61,0	62	39,0	159
Process innovation	113	18,7	492	81,3	605
Product and process innovation	52	8,6	553	91,4	605

Source: author's elaboration using BEEPs datasets of Uganda

The descriptive statistics reveal that the majority of establishment operate under relatively traditional and less formalized structures. The adoption of structures managerial and technological practices appears limited. Less than one-third (29,6%) offer formal training programs, and just 14,9% use technology licensed from foreign companies. Moreover, R&D engagement is particularly low, with only 10,1% reporting R&D expenditures, suggesting weak innovation structure. Financial access and investment activity are also moderate. Around 23% of firms have loans from financial institutions and a similar proportion purchased fixed assets, reflecting limited capital expansion capacity.

Regarding environmental practices, more than half of the firms, (52,7%) adopt energy management measures, which is relatively encouraging. However, only 30,7% monitor their CO2 emissions, indicating that structured environmental accountability remains underdeveloped. The competitive environment appears challenging, as 67,4% of firms report competition from informal or unregistered businesses. This high level of informal competition may constrain productivity and innovation incentives.

Managerial structure is highly concentrated, with 80% of top managers being firm owners, reflecting centralized decision-making. Female representation in top management remains low (20,3%). However, for the innovation capacities, innovation activity is presented but limited. About 26,3% of firms report product innovation, 18,7% are process innovation and of course there is only 8,6% of the firms of the sample engage in both types of innovation simultaneously. Among product innovators, 61% introduced innovations targeting their main product, suggesting that innovation efforts are primarily market-driven rather than

exploratory. Overall, the table suggests that the firms in the sample are predominantly small, owner-managed businesses operating in a competitive and partially informal environment, with modest investment capacity and relatively low levels of technology upgrading and innovation activity.

2.4.1 Data analysis using content analysis

Based on the different responses of the firms, Ugandan firms exhibit a high level of product innovation, mainly driven by incremental improvements, product diversification, and market expansion rather than radical technological breakthroughs. The product innovation of Ugandan firms mainly focused on six kinds. First, the majority of firms with a rate between 58 to 62% of the firms introduced entirely new products that were previously not offered by the establishment, such as new food items and menus (burgers, Asian dishes, pastries, organic foods), new manufactured goods (tiles, furniture, mattresses, doors, grills), new consumer goods (electronics, phones, stationery, cosmetics) and new services bundled as products (outside catering, consultancy, tourism packages). This indicates that product diversification is the dominant innovation strategy among Ugandan firms. Second, a significant share of firms focused on improving quality, size, durability, performance, or design of existing products. A rate of between 23 to 26% of the total of the innovative firms improved packaging and branding, improve better materials (lightweight, durable, insulated), enhanced performance (fuel efficiency, lubricants, engines) such as size modifications and creation of 1kg soaps, smaller bread units, varied sugar packs. These are mainly incremental innovations, aimed at competitiveness and customer retention. In the third rate, around 20% of the innovative firms extended existing product lines by adding new flavors, designs, sizes, or styles, use Additional variants (different roofing profiles, biscuit flavors, fabrics, beads), and Bundled or mixed products (mixed poultry feed, blended flour, porridge mixes). This reflects market-driven innovation, responding to changing consumer preferences. For the fourth place, around 17% of the Firms added value through processing raw products (roasted coffee vs green coffee), combining ingredients (blended flour, mixed feeds) or using functional enhancement (anti-mosquito paint, fortified oils, herbal supplements).

This shows strong engagement in low-cost value addition, especially in agro-processing and food sectors. In the fifth place, a smaller proportion of the innovative firms with a rate around 9% involved technology-intensive products, such as computerized wheel alignment, solar inverters and solar appliances, applying GPS- and biometric-enabled education software, or using news apps, WiFi services, order tracking machines.

Indicates limited but growing technological innovation capacity, often linked to imported technology. In the latest place, just Some firms with a rate of 7% introduced eco-friendly and health-oriented product such as create environmentally friendly cookstoves, produce organic foods, or creation of health-conscious products (sugar-free cakes, herbal medicine). Using content analysis, and through counting the occurrence of the responses of the respondents about the natures of the innovation process, the firms' process innovations clearly fall into six major categories that are delivery and distribution innovations, digitalization and information communication technologies, production technology and automation, payment and financial process innovation, packaging and quality improvement and organizational and service process innovations. The most prevalent process innovation among Ugandan firms is delivery and distribution innovations (around 37%) (the firms prioritize market access, customer convenience and competitiveness, responding to transport challenges and customer demand) , where the kind of development of the process were the development of home delivery, or what is called door to door delivery, using

motorcycles, vans and boda bodas, applying free delivery for bulk buyers or applying Online and phone-based ordering.

Digitalization and information and communication technologies take the second most dominant innovation (with around 25%) where the Ugandan firms are transitioning from manual to digital systems to improve efficiency, transparency and speed. The most pictures of these innovations are creation online selling platforms, creation of digital inventory and POS systems, using online bookings and reservations, using electronic procurement, in addition to using billing and auditing and accounting software.

Third parts of the firms aim to increase output (around 21%), quality, and consistency while reducing waste and labor intensity. From the kinds of the innovation, there are automated machines, using electric ovens and sewing machines, using Laser cutting, automated bending, using fully automated plants in addition to improved milling, pasteurization and drying systems. 8% of the firms of the sample launch new and innovative procedures in payment and financial, this latest take the fourth place in the process innovation among Ugandan innovative firms in the process innovation. These innovations are in the aim of reducing transaction friction and enhance customer trust. Among this amelioration, there are the use of mobile money (MTN MOMO), use of Visa card and POS machines, using bank transfers and using automated commission and credit assessment systems.

Packaging is increasingly used as a competitive and trust-building tool; therefore, it takes the fifth place among the innovation processes (6%) . These improvements are branded packaging, improved contained sizes, individual wrapping in addition to using Quality certification and anti-counterfeit systems.

In addition to the different axes cited before, the firms still focus more on operational efficiency that on organizational redesign, therefore, organizational and service process take also place among the previous processes. From the types of process, there is new hiring procedures, the creation of customer feedback platforms, creation of Loyalty bonuses and discounts, in addition to Entertainment events to boost sales.

Table 3: logit model of determinant of innovation in Uganda

Variables	Product innovation	Process innovation
Constant	2,977*** (0,702)	3,319*** (,786)
Experience of top manager (exp)	,015 (,267)	-,016 (,014)
Top manager is a woman (gnd)	-,277 (0,13)	-,247 (,284)
Top manager owns the firm (own)	,730** (,306)	,311 (,297)
Age of the firm (age)	,008 (,009)	,024** (,012)
Sampling size medium ($size$)	,204 (,344)	-,048 (,391)
Sampling size large ($size$)	,470 (,341)	-,416 (,373)
Sector : retailing (sct)	,507** (,247)	-,188 (,268)
Sector : service (sct)	-,178 (,303)	-,369 (,313)
Formal Training program (trn)	-,269 (,255)	-,330 (,274)
Using foreign owned technology license (FOT)	-,101 (,318)	,678** (,336)
R&D expenditures (RD)	1,947*** (,344)	1,075*** (,345)
Purchasing any fixed assets (PFE)	-,343 (,257)	,855*** (,265)
Adopt energy management measures (ENM)	-,223 (,225)	,539** (,245)
Competition against informal competitors (INC)	1,040*** (,263)	,648*** (,272)
Innovation process (IPS)	,680*** (,257)	
Having a loan from a financial institution (fin)	,416 (,264)	,514* (,283)
Observation	605	605

Notes: Standard errors in parentheses, ***p < 0.01, **p < 0.05, *p < 0.1.

3 Results and discussion:

The logit results indicate several significant determinants of both product and process innovation among the firms of the sample from Uganda. Starting with the determinant of product innovation, managerial ownership positively and significantly influences product innovation (β = 0.730). Firms where the top manager is also the owner are more likely to introduce new products. This suggests that entrepreneurial control may facilitate faster decision-making and greater strategic flexibility, consistent with Schumpeterian entrepreneurial theory. Firm age does not significantly affect product innovation, indicating that introducing new product is not necessarily linked to accumulated experience. Sectoral effects are notable also. Firms in retailing are significantly at 5% more likely to introduce product innovation

(β = 0.507), suggesting that market proximity and customer interaction may stimulate product adaptation and differentiation strategies. The most striking results concerns R&D expenditures, which strongly and positively affect product innovation at 1% (β = 1.947). This confirms the central role of knowledge investment in fostering innovative outputs and supports the resources-based view RBV, which emphasizes internal capabilities as drivers of competitive advantage. Additionally, firms facing competition from informal competitors are more likely to introduce product innovation at 1 %(β = 1.040). Unlike many developing contexts where informality discourage innovation, this result suggests that competitive pressure in Uganda may stimulate differentiation strategies through new products. The positive and significant coefficient of process innovation at 1% (β = 0.680) confirms complementarity between innovation types; firms improving processes are also more likely to introduce new product.

The determinants of process innovation show both similarities and differences. Firms age positively and significantly affect process innovation (β = 0.024) at 5%, indicating that accumulated operational experience enhances incremental efficiency improvements. Technological upgrading variables are highly significant:

- Use of foreign technology licenses positively influences process innovation at 1% (β = 0.024)
- R&D expenditures strongly promote process innovation with (β = 1.075)
- Purchasing fixed assets has a large significant positive effect at 1% (β = 0.855).

These finding suggest that process innovation in Uganda is closely linked to capital investment and technological modernization. Firm investing in machinery equipment, and external technologies improve production efficiency. Environmental commitment also plays a role. Firms adopting energy management measures are more likely to engage in process innovation (β = 0.539), indicating that sustainability practices may stimulate operational improvement. Access to finance matters as wells. Having a loan from a financial institution positively affects process innovation at 10% (β = 0.514), suggesting that financial access support technological upgrading. In the end, competition from informal firms significantly and positively affects process innovation at 1% (β = 0.648), reinforcing the idea that competitive pressure stimulates efficiency improvements.

Conclusion and recommendation:

The study examined the determinants of product and process innovation among Ugandan SMEs using BEEPS firm-level data and binary logistic regression analysis. The findings reveal that innovation in Uganda is primarily capability-driven and competition-induced. R&D expenditure emerges as the most powerful determinants of both product and process innovation, confirming the central role of knowledge investment in driving innovative outcomes. Product innovation is significantly enhanced by managerial ownership, retail sector activity, competition from informal firms, and complementarity with process innovation. Process innovation, in contrast, is strongly influenced by firm age, foreign technology licensing, fixed asset acquisition, energy management adoption, financial access and competitive pressure.

Descriptive analysis further indicates that innovation among Ugandan firms is largely incremental and market-oriented. Product innovation is dominated by diversification and upgrading rather than radical technological breakthroughs, while process innovation focuses mainly on delivery systems, digitalization, automation and payment technologies.

The positive role of competitive pressure from informal firms suggests that market rivalry stimulates differentiation and efficiency improvements. However, the relatively low prevalence of R&D activity and quality certification points to systemic weaknesses in the broader innovation ecosystem. From a policy perspective, strengthening Uganda's innovation performance requires:

- Expending financial support mechanisms for R&D and technological upgrading,
- Enhancing absorptive capacity through skills development and managerial training,
- Supporting technology transfer and modernization of production systems.
- Encouraging formalization to create fair and stable competitive environments.
- Promoting green and sustainable innovation initiatives.

References:

Aghion, P., Bloom, N., Blundell, R., Griffith, R., & Howitt, P. (2005). Competition and Innovation: An Inverted-U Relationship. *The Quarterly Journal of Economics*, *120*(2), 701–728.

Altreiter, C., Gräbner-Radkowitsch, C., Pühringer, S., Rogojanu, A., & Wolfmayr, G. (2025). Theorizing competition: An interdisciplinary framework. *Competition & Change*, *29*(5), 593–614. https://doi.org/10.1177/10245294251330343

Amin, M. (2025). How does competition from informal firms impact research and development by formal manufacturing small and medium enterprises in the developing and emerging economies? *Kyklos*, *78*(1), 45–73. https://doi.org/10.1111/kykl.12410

Atuahene-Gima, K. (1993). International Licensing of Technology: An Empirical Study of the Differences between Licensee and Non-Licensee Firms. *Journal of International Marketing*, *1*(2), 71–87. https://doi.org/10.1177/1069031X9300100205

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

Benoît Godin. (2019). How Innovation Evolved from a Heretical Act to a Heroic Imperative. In *Does America Need More Innovators?* (MIT press). https://direct.mit.edu/books/oa-edited-volume/4198/Does-America-Need-More-Innovators

Bourouaha, A., & Maliki, S. B. (2021a). Determinants of firms' innovation and the role of R&D investment and training: Empirical evidence from Tunisian SMEs. *International Journal of Business Innovation and Research*, *25*(3), 285. https://doi.org/10.1504/IJBIR.2021.116390

Bourouaha, A., & Maliki, S. B. E. (2018). From Underdeveloped to Innovation Learners: Case of sub-Saharan African countries and lesson for MENA countries. *Les Cahiers Du Mecas*, *14*(1), 186–199.

Bourouaha, A., & Maliki, S. B.-E. (2021b). Determinants of firms' innovation and the role of R&D investment and training: Empirical evidence from Tunisian SMEs. *International Journal of Business Innovation and Research*, *25*, 285. https://doi.org/10.1504/IJBIR.2021.116390

Canare, T., & Francisco, J. P. (2021). Does Competition Enhance or Hinder Innovation? Evidence from Philippine Small and Medium-Sized Enterprises. *Economics Department Faculty Publications*. https://archium.ateneo.edu/economics-faculty-pubs/188

Doan Thi Ngoc, T., Do Huynh Lam, T., & Nguyen Van, D. (2025). Internationally recognized quality certification, human capital and process innovation: The moderating role of informal competition. *International Journal of Innovation Science*. https://doi.org/10.1108/IJIS-03-2025-0111

Dostie, B. (2018). The Impact of Training on Innovation. *ILR Review*, *71*(1), 64–87. https://doi.org/10.1177/0019793917701116

Federo, R., Ponomareva, Y., Aguilera, R. V., Saz-Carranza, A., & Losada, C. (2020). Bringing owners back on board: A review of the role of ownership type in board governance. *Corporate Governance: An International Review*, *28*(6), 348–371. https://doi.org/10.1111/corg.12346

Gillmore, E., Andersson, U., & Dellestrand, H. (2023). Between a rock and a hard place: The consequences of complex headquarters configurations for subsidiary R&D activities. *Global Strategy Journal*, *13*(1), 217–247. https://doi.org/10.1002/gsj.1431

Hadi Farid, Abu Daud Silong, & S.K. Sarkar. (2010). Application of Logit Model in Innovation Adoption: A Study on Biotechnology Academic Researchers in Malaysia. *Application of Logit Model in Innovation Adoption: A Study on Biotechnology Academic Researchers in Malaysia*, *9*(3), 282–287.

Hlioui, Z., Gabsi, M., Omri, A., Hlioui, Z., Gabsi, M., & Omri, A. (2022). Informal Competition Effect on SMEs' Innovation: Do Credit Constraints Matter? Evidence from Eastern European Countries. *Sustainability*, *14*(21). https://doi.org/10.3390/su142113874

Huergo, E., & Jaumandreu, J. (2004). How Does Probability of Innovation Change with Firm Age? *Small Business Economics*, *22*(3), 193–207. https://doi.org/10.1023/B:SBEJ.0000022220.07366.b5

Jjagwe, R., Kirabira, J., Mukasa, N., & Amanya, L. (2024). The drivers and barriers influencing the commercialization of innovations at research and innovation institutions in Uganda: A systemic, infrastructural, and financial approach. *Journal of Innovation and Entrepreneurship*, *13*. https://doi.org/10.1186/s13731-024-00435-y

Kaine, G., & Higson, M. (2006). *Policy Change as Innovation*. https://doi.org/10.13140/RG.2.2.19866.93121

Kamunyori, S., Al-Bader, S., Sewankambo, N., Singer, P. A., & Daar, A. S. (2010). Science-based health innovation in Uganda: Creative strategies for applying research to development. *BMC International Health and Human Rights*, *10 Suppl 1*(Suppl 1), S5. https://doi.org/10.1186/1472-698X-10-S1-S5

Kogabayev, T., & Maziliauskas, A. (2017). The definition and classification of innovation. *HOLISTICA – Journal of Business and Public Administration*, *8*(1), 59–72. https://doi.org/10.1515/hjbpa-2017-0005

Kunttu, L., Dan, S., Kalliomäki, H., & Kuusisto, J. (2021). *Assessing Evolving Innovation Space in Oslo Manuals*.

Larsen, M. M., Birkinshaw, J., Zhou, Y. M., & Benito, G. R. G. (2023). Complexity and multinationals. *Global Strategy Journal*, *13*(3), 535–551. https://doi.org/10.1002/gsj.1493

Maldonado-Mariscal, K., & Alijew, I. (2023). Social innovation and educational innovation: A qualitative review of innovation's evolution. *Innovation: The European Journal of Social Science Research*, *36*(3), 381–406. https://doi.org/10.1080/13511610.2023.2173152

Malerba, F. (2002). Sectoral systems of innovation and production. *Research Policy, Innovation Systems*, *31*(2), 247–264. https://doi.org/10.1016/S0048-7333(01)00139-1

Mariani, M. M., Machado, I., & Nambisan, S. (2023). Types of innovation and artificial intelligence: A systematic quantitative literature review and research agenda. *Journal of Business Research*, *155*, 113364. https://doi.org/10.1016/j.jbusres.2022.113364

Marimon, F., & Casadesús, M. (2017). Reasons to Adopt ISO 50001 Energy Management System. *Sustainability*, *9*(10), 1740. https://doi.org/10.3390/su9101740

Minetti, R., Murro, P., & Paiella, M. (2015). Ownership structure, governance, and innovation. *European Economic Review*, *80*, 165–193. https://doi.org/10.1016/j.euroecorev.2015.09.007

Musandiwa, T. J., & Ngwakwe, C. C. (2020). Effect of Technology Adoption on New Product Innovation. *Managing Global Transitions*, *18*(3), 177–194. https://doi.org/10.26493/1854-6935.18.177-194

Mwadzingeni, L., Dandira, M., Kutywayo, D., Mwadzingeni, L., Chiwawa, A., & Simatele, M. D. (2025). Impact of capacity building through learning, training, and coaching on agricultural innovation. *PLOS ONE*, *20*(1), e0314004. https://doi.org/10.1371/journal.pone.0314004

Na, K. (2021). The Effect of On-the-Job Training and Education Level of Employees on Innovation in Emerging Markets. *Journal of Open Innovation: Technology, Market, and Complexity*, *7*(1), 47. https://doi.org/10.3390/joitmc7010047

Na, K., Shin, K., Na, K., & Shin, K. (2019). The Gender Effect on a Firm's Innovative Activities in the Emerging Economies. *Sustainability*, *11*(7). https://doi.org/10.3390/su11071992

Nardo, R., & Aprilyani, R. (2024). The Effect of Training and Development on Innovative Behaviour in Organisations. *Journal of International Conference Proceedings*, *7*(1), 272–283. https://doi.org/10.32535/jicp.v7i1.3064

Nekoye, B., Tsuma, E., & Wanjere, D. (2025). Impact of Staff Training on Enhancing Innovative Work Behavior among Non-Teaching Staff in Public Universities in Western Kenya. *African Journal of Empirical Research*, *6*(2), 86–92. (Kenya). https://doi.org/10.51867/ajernet.6.2.7

Nwarueze, C., Sutrisna, M., & Heerden, H. V. (2025). *The Adoption of Energy Efficiency Measures in Social Housing: Trends, Benefits, Barriers, and Enablers*. Research Square. https://doi.org/10.21203/rs.3.rs-7483852/v1

OECD. (2015). *Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development*. OECD Publishing. https://doi.org/10.1787/9789264239012-en

OECD. (2018). Education at a Glance 2018: OECD Indicators. *Education at a Glance*, *2018*. https://doi.org/10.1787/eag-2018-en

OECD, & Eurostat. (2018). Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation, 4th Edition. *The Measurement of Scientific, Technological and Innovation Activities*, *2018*. https://doi.org/10.1787/9789264304604-en

Oki, S. (2019). 'Innovation' as an Adaptation of 'Progress': Revisiting the Epistemological and Historical Contexts of These Terms. In S. Lechevalier (Ed.), *Innovation Beyond Technology: Science for Society and Interdisciplinary Approaches* (pp. 47–62). Springer. https://doi.org/10.1007/978-981-13-9053-1_3

Okrah, J., & Irene, B. (2023). The effect of top managers' years of experience on innovation. *International Journal of Innovation Studies*, *7*(3), 208–217. https://doi.org/10.1016/j.ijis.2023.03.004

Porter, M. E. (with Chandler, A. D.). (1985). *Competitive advantage: Creating and sustaining superior performance*. Free Press ; Collier Macmillan.

Ritter-Hayashi, D., Vermeulen, P., & Knoben, J. (2019). Is this a man's world? The effect of gender diversity and gender equality on firm innovativeness. *PLOS ONE*, *14*(9), e0222443. https://doi.org/10.1371/journal.pone.0222443

Romain, R., & Agogué, M. (2021). Developing radical innovation capabilities: Exploring the effects of training employees for creativity and innovation. *Creativity and Innovation Management*, *30*. https://doi.org/10.1111/caim.12423

Schumpeter, J. (1934). The Theory of Economic Development. In *Joseph Alois Schumpeter* (Vol. 1, pp. 61–116). Kluwer Academic Publishers. https://doi.org/10.1007/0-306-48082-4_3

Schumpeter, J. A., & Swedberg, R. (1942). *Capitalism, socialism and democracy*. Routledge. https://doi.org/10.4324/9780203202050

Solarino, A. M., & Boyd, B. K. (2020). Are all forms of ownership prone to tunneling? A meta-analysis. *Corporate Governance: An International Review*, *28*(6), 488–501. https://doi.org/10.1111/corg.12344

Sung, S. Y., & Choi, J. N. (2014). Do organizations spend wisely on employees? Effects of training and development investments on learning and innovation in organizations. *Journal of Organizational Behavior*, *35*(3), 393–412. https://doi.org/10.1002/job.1897

Timothy, V. L. (2022). The effect of top managers' human capital on SME productivity: The mediating role of innovation. *Heliyon*, *8*(4), e09330. https://doi.org/10.1016/j.heliyon.2022.e09330

Trentin, G. (2009). Technology Enhanced Learning in Continuing Medical Education: In A. Cartelli & M. Palma (Eds.), *Encyclopedia of Information Communication Technology* (pp. 742–749). IGI Global. https://doi.org/10.4018/978-1-59904-845-1.ch098

Ullah, B. (2022). The impact of quality certification on SME innovation and the role of institutions. *Research in International Business and Finance*, *62*, 101748. https://doi.org/10.1016/j.ribaf.2022.101748

Valenzuela-Muñoz, A., Vásquez-Torres, M. D. C., Flores-Lopez, J. G., & Carrillo-Armenta, R. A. (2024). Influence of training as a strategy to promote organizational innovation in private sector service MSMEs. *Journal General Economics*, *8*(14). https://doi.org/10.35429/JGE.2024.8.14.1.9

Vidican, R. D., & Hepeş, R. A. (2023). CONSIDERATIONS REGARDING THE CONCEPT OF COMPETITION. *AGORA INTERNATIONAL JOURNAL OF JURIDICAL SCIENCES*, *17*(2), 184–194. https://doi.org/10.15837/aijjs.v17i2.6484

Villasalero, M. (2018). Multi-Business Firms, Knowledge Flows and Intra-Network Open Innovations. *Journal of the Knowledge Economy*, *9*(1), 162–179. https://doi.org/10.1007/s13132-015-0330-z

Wayoro, D., Nonguierma, W., & Parkouda, M. (2024). Two Sides Of The Same Coin? A Panel Data Approach To The Innovation-Standard Relationship. *Journal of Standardisation*, *3*. https://doi.org/10.59490/jos.2024.7130

Xi, X. (2023). Multi-establishment firms, misallocation, and productivity. *Journal of Economic Dynamics and Control*, *154*, 104705. https://doi.org/10.1016/j.jedc.2023.104705

Yin, C., Salmador, M. P., Li, D., & Lloria, M. B. (2022). Green entrepreneurship and SME performance: The moderating effect of firm age. *International Entrepreneurship and Management Journal*, *18*(1), 255–275. https://doi.org/10.1007/s11365-021-00757-3