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## Article

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# Can Islamic finance enhance the innovation capacity of Cameroonian SMEs? Empirical evidence based on a multivariate probit approach

Ali Haruna<sup>a,\*</sup>, Honoré Tekam Oumbé<sup>a</sup>, Armand Mboutchouang Kountchou<sup>a</sup>, Charles Bertin Pilag Kakeu<sup>b</sup>

<sup>a</sup> Faculty of Economics and Management, University of Dschang, Dschang, Cameroon

<sup>b</sup> Faculty of Economics and Management Sciences, University of Bamenda, Bamenda, Cameroon

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## ABSTRACT

This study examines the effects of the Islamic mode of financing on the innovation capacity of SMEs in Cameroon using a sample of 1358 SMEs. Results of the multivariate probit model indicate that Islamic finance enhances process innovation, product innovation, and marketing innovation. While the effects on organizational innovation are positive, they are statistically insignificant. Our main results equally indicate that the effects of Islamic finance on the innovation capacity of SMEs are more pronounced on technological innovation (process and product) than non-technological innovation (marketing and organizational). Policymakers are encouraged to put in place the necessary mechanisms for the promotion of Islamic finance such as the enacting of laws that ensure the creation of full-fledged Islamic banks, and raising awareness about the benefits and specificities of this mode of finance for the financing of SME innovation.

## 1. Introduction

Innovation in all its forms be it process, product, marketing, or organization is considered a central driver of economic development and the growth and competitiveness of firms and nations (Romer, 1986, 1990; Schumpeter, 1934; Solow, 1956). As the business environment becomes more and more competitive in the face of relentless globalization, SMEs as the most important contributors to the economic growth of nations, especially developing countries, are obliged to innovate as a way of preserving their survival (Chege and Wang, 2020; Smallbone et al., 2022; Wellalage and Locke, 2020). The importance of innovation as a major factor for economic growth is highlighted in the definition of the 2015 Sustainable Development Goals (SDGs) of the United Nations, particularly the 9th goal, which focuses on promoting sustainable and inclusive industrialization and building a resilient infrastructure through investment in research and innovation. As a result, policymakers have made it a top priority to create and spread innovation for their development agenda (Fallon and Wassim, 2023; Hales and Birdthistle, 2022, pp. 1–8).

The place occupied by innovation in the national productive

apparatus has led to overwhelming interest from managers, policy-makers, and researchers in recent years, giving rise to abundant literature, both theoretical and empirical vis-à-vis its drivers especially concerning SMEs. The literature on the determinants of the innovation capacity of SMEs can broadly be divided into two main strands: some studies have focused particularly on the idiosyncratic determinants of innovation particularly firm characteristics and managerial characteristics (Cooper et al., 2016; Cropley and Oppert, 2018, pp. 35–51; Daneji et al., 2019; Sierra-Morán et al., 2022; Zhang et al., 2022); others have rather looked at the contextual determinants (De Noni et al., 2013; Ferreira et al., 2017; Hewitt-Dundas, 2013; Wendji and Kakeu, 2022). Among the contextual determinants of innovation, the place occupied by the financial system cannot be overemphasized (Ayyagari et al., 2011; Giannetti, 2012), particularly bank credit (Adegboye and Iweriebor, 2018; Fryges et al., 2015; Rathnayake et al., 2022; Wellalage and Locke, 2020), since the creation and the implementation of innovation are costly and warrant the mobilization of huge financial resources (Klein and Knight, 2005).

However, despite the role played by conventional bank credit as highlighted by the above studies, this financial system has been

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\* Corresponding author.

E-mail addresses: [haruna.ali@univ-dschang.org](mailto:haruna.ali@univ-dschang.org) (A. Haruna), [h\\_tekam@yahoo.fr](mailto:h_tekam@yahoo.fr) (H.T. Oumbé), [armand.mboutchouang@univ-dschang.org](mailto:armand.mboutchouang@univ-dschang.org) (A.M. Kountchou), [pilagbertin@yahoo.com](mailto:pilagbertin@yahoo.com) (C.B. Pilag Kakeu).

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questioned since its purely profit-maximizing behavior tends to exclude SMEs from bank loans, in the worst cases this credit even increases the debt ratio of small enterprises (Subhabrata and Laurel, 2016) thereby hampering their innovation efforts and hastening their demise. For this reason, many studies have highlighted the importance of Islamic finance compared to traditional finance (Doukkali and Hefnaoui, 2020; Mahboubi and Benyacoub, 2020; Omri et al., 2019) since this mode of finance is interest-free and based on the profit and loss sharing principle, making it the most ideal for SMEs in their efforts to create and implement new knowledge. The studies though on the role of the financial system in SME innovation failed to take into account the specificities of this mode of finance which differs greatly from conventional finance in terms of business practice and governance.

Thus this paper to the best of our knowledge is the first to examine the effects of Islamic finance on the innovation capacity of SMEs. In addition to filling this literature gap, this paper has the following contributions: firstly, it employs a multivariate probit model which is ideal for a multi-category choice, permitting each enterprise to choose between the several innovation types it practices; this model equally permits us to extend our analyses on the role of Islamic finance in innovation by permitting us to calculate predicted probabilities. Secondly, from a conceptual angle, the study considers all four types of innovation (process, product, marketing, and organizational innovations) for a more holistic analysis of the effects of Islamic finance on the innovation capacity of SMEs in Cameroon.

The remainder of this paper is structured as follows. Section 2 presents the literature review. Section 3 discusses the methodology. Section 4 focuses on the results and discussion, and section 5 draws conclusions and recommendations.

## 2. Literature review

### 2.1. Islamic finance concept and products

Islamic finance is a financial system whose operations and policies are based on the norms and rules of Islamic Law (Shari'aa),<sup>1</sup> and reflect the injunctions of Islam (Pollard and Samers, 2007; Warde, 2000). Four main principles govern Islamic financial activities. First *riba* which is the taking or giving of interest (Hassan and Lewis, 2014) is prohibited. This is because profit should not be obtained from the exchange of money for money, rather profit should be earned from trade in goods and services (Mbawuni and Nimako, 2017). Islam, however, permits a return on capital, provided that capital participates in the productive process and is exposed to business risk (Abedifar et al., 2016; Hassan and Lewis, 2014). The concept of profit and loss sharing (PLS) replaces that of interest. Second, Islamic finance prohibits *gharar*. *Gharar* refers to economic transactions that have absolute or excessive uncertainty or risk or hazard in business transactions (Abedifar et al., 2016; Hassan and Lewis, 2014). Third, *Maysir* (gambling) is prohibited. *Maysir* involves the acquisition of money by luck and transaction which is linked to gambling or betting (Nakhavali, 2017). Lastly, Islam considers products such as alcohol, pork, pornography, and others as "*haram*", meaning strictly forbidden, and are as such prohibited (Nakhavali, 2017). Islamic finance differs from the conventional mode in terms of business organization, economic roles, law, origin, and supervisory roles (Wan Ibrahim and Ismail, 2015). This mode of finance is based on the principles of ethics and solidarity and is considered "pro-poor" (Haruna et al., 2023; Kountchou et al., 2023).

Many Islamic financial products have been widely discussed in the Islamic finance literature (Hassan and Lewis, 2014; Nakhavali, 2017). According to these studies, the most common Islamic finance products include (i) Mudarabah, the provision of capital in a partial equity

partnership; (ii) Musharakah, full equity partnerships, (iii) Murabaha, an instrument used for financing the purchase of goods; (iv) Bai Salam, advance sale contracts; (v) Istisna, or manufacturing contracts; (vi) Ijarah, financing in the form of lease; and (vii) Quard Hassan, a system of benevolent loans. This mode of finance is equally made up of different compartments such as Islamic banking, Islamic bond market, takaful (insurance), Islamic funds, and other Islamic finance institutions (e.g. zakat institutions).

### 2.2. Islamic banking practices in Cameroon

Islamic finance was formally introduced in Cameroon in 2016 (UN-Cameroon, 2019) following the creation of the first Islamic finance window by Afriland First Bank, one of the main commercial banks in the country which has branches in many other African countries. The main reason for its introduction in Cameroon was to spur economic activities, especially through the financing of SME entrepreneurship (MIFC, 2017). Before this formal introduction, there was the launched of the pilot project by the Cameroonian authorities with the support of the Islamic Development Bank, where three Islamic banking products: murabaha, mudarabah, and musharakah were successfully tested in the three northern-Muslim-dominated regions of the country. After the successful introduction of Islamic finance in 2016, this mode of finance has gradually gained the enthusiasm of financial actors across the country given the advantages it presents over its conventional counterpart. This is evident by the growing number of microfinance institutions and banks that offer Islamic finance products in the country, especially in Douala, Yaounde, and the Muslim-dominated northern regions of the country. Banks such as CCA, and UBA, and microfinance institutions such as Savanna Islamic Finance, Credit du Sahel, Advans, CECIL, etc offer Sharia-compliant products.

Thus as of today, there are no full-fledged Islamic banks in Cameroon except for Savana Microfinance. However, plans are in place to change this, especially with the enactment of the law governing Islamic finance activities in the country by the banking commission, COBAC in 2022 (GICAM, 2022). This is part of the national strategy program for the promotion of financial inclusion in Cameroon through Islamic finance (MINFI, 2023). Equally with the increasing ties between Cameroon and the Islamic Development Bank, it is expected that this mode of finance will be truly rooted in the Cameroonian financial system soon. As of today, the authorities put the penetration rate at just about two percent.

### 2.3. Theoretical underpinnings

The Schumpeterian innovation model states that every enterprise must carry out "new combinations" of factors of production if it is to guarantee its survival in a constantly evolving business environment (Schumpeter, 1934). This postulate has however been emphasized with time by recent theories that identify innovation as the main driver of the economic growth of nations (Howitt and Aghion, 1998; Romer, 1990). The innovation theory of Schumpeter (1934) equally identified the means through which enterprises can implement their innovation endeavors and the role of the financial system has been well underlined by this theory since the innovation game is not only costly but equally risky, with an uncertain degree of outcomes (Nawrocki and Jonek-Kowalska, 2022). The financial system is mandated with the provision of the necessary financial resources to those enterprises that are willing to create new knowledge or absorb existing knowledge. Later studies particularly in the area of financial intermediation have equally stressed this role. The theory of financial intermediation (Gurley and Shaw, 1955, 1967) qualified the financial system as a catalyst for entrepreneurship since it carries out the "qualitative transformation of assets", thereby helping reduce risks linked to asymmetric information, control costs, etc. With this role, the financial system can identify and finance enterprises with the highest probability of succeeding and implementing innovation processes. Other studies have extended the endogenous

<sup>1</sup> Sharia law is based on the Muslim Holy Book (the Quran) and the traditional teaching of Prophet Muhammad (PBUH) in the Sunnah.

growth theories to include the financial system development as an important determinant of long-term economic growth (Bencivenga and Smith, 1991; Greenwood and Jovanovic, 1990; Hermes et al., 2011; King and Levine, 1993a, 1993b; Levine, 1997; Pagano, 1993; Roubini and Sala-i-Martin, 1992). These studies further underlined the idea that the financial system reduces liquidity and idiosyncratic risk, transaction costs, and information asymmetry.

The above theories have been employed in the finance literature to show the role of the different aspects of the finance industry such as conventional microfinance (Elle, 2012; Sussan and Obamuyi, 2018), conventional banks (Zavadska, 2018) in enhancing innovative activity. This study adopts the innovation theory of Schumpeter (1934) and the theory of financial intermediation (Gurley and Shaw, 1955, 1967) to examine the effects of Islamic finance on the innovation capacity of Cameroonian SMEs. To the best of our knowledge, this is the first study to examine this relationship.

#### 2.4. The effects of finance on innovation: a review of the empirical literature and hypotheses development

A plethora of empirical studies has examined the role played by the financial system when it concerns enterprise innovation, by employing different measures of innovation such as the input-based, output-based, and the technique of the Community Innovation Surveys in the Organization for Economic Cooperation and Development (OECD), included in the Oslo Manual (2005). The input-based measure of innovation is especially concerned with the total expenditure in Research and Development (R&D) by an enterprise while the output-based measure is particularly concerned with the number of patents generated. The method highlighted in the Oslo Manual (2005) is considered the most convenient by the literature and is focused on using surveys to collect information on whether an enterprise has practiced the four forms of innovation: product, process, marketing, and organizational. Irrespective of the measure used, the results of the different empirical studies have been unanimous on the enhancing effects of the financial sector on the innovation capacity of enterprises.

As far as R&D is concerned, Micucci and Rossi (2012) in a study comparing the different sources of finance for research and development of firms in Italy concluded that firms that rely on bonds and outside equity financing tend to invest more in R&D, suggesting that relationship lending is only a partial substitute for direct access to financial markets. As a whole, their analysis indicates that financial markets are crucial for the financing of innovation. These results were underlined by Nanda and Nicholas (2014) who were rather interested in the effects of banking distress on innovation. Their study shows that there exists a negative relationship between bank distress and the level, quality, and trajectory of firm-level innovation during the Great Depression, particularly for R&D firms operating in capital-intensive industries. Fryges et al. (2015) concluded that a higher share of loan financing allows for more R&D in young firms and, at the same time, a higher R&D intensity allows for a higher loan share while in a recent study, Xiong et al. (2023) showed that Digital Inclusive Finance (DIF) plays a positive role in boosting company R&D innovation with, DIF coverage being the most significant in promoting R&D innovation among the three DIF sub-dimensions, especially for private enterprises, small and medium-sized enterprises, secondary and tertiary industries, and high-growth enterprises.

Another strand of the literature focuses on the effects of the financial sector on the number of patent applications by enterprises as a measure of innovation. Rathnayake et al. (2022) found that the acquisition and provision of commercial credit have promoted the number of enterprise technological innovations and significantly improved their quality. These results confirmed that of Liu et al. (2019) who found bank loans enhance technological innovation approximated by the number of patent applications of Chinese listed companies. Their findings support the proponents of giving loans to entrepreneurs. In the same light, Ferdousi

(2015) found even though larger loans can increase the income level of an enterprise, there is the need to use the income to finance innovation as a costly venture otherwise less innovative business practices might threaten such income.

Recently, there has been a shift from the use of patents and R&D as measures of innovation capacity to the use of the approach developed by the Oslo Manual (2005), considered more advantageous and which is based on a set of questions asked to actors as to whether they have introduced product, process, marketing, or organizational innovation (Mairesse and Mohnen, 2010). This technique has been applied especially in less developed countries where the rate of patenting and R&D expenditure are still very low. Based on this approach, using the logit estimation technique, Adegbeye and Iweriebor (2018) showed that the ease of accessing bank credit is the strongest positive force in driving all types of innovation among SMEs in Nigeria. In the same vein, the source of investment financing matters in terms of how it affects innovation: both internal and external sources improve investment in product, process, and organizational innovation, but only external financing has a significant effect on R&D spending and the use of foreign licensed technology. Overall spending on R&D is only driven by access to external finance by SMEs. Ruiz-Palomo et al. (2022) showed that relaxing financial constraints helps SMEs to innovate in both technological and management innovation, with the effect of the relaxation of financial constraints significantly greater in companies managed by women. Wellalage and Locke (2020) indicated that formal credit availability boosts all four types of innovations.

If the above is true for the conventional mode of financing, then it certainly should be for Islamic finance. This mode of finance which is considered pro-SMEs in the provision of financial services and its participatory nature has the potential of even producing a larger effect than the conventional mode of finance. Based on the above discussions, we post the following hypotheses.

- H1. Islamic finance positively and significantly affects the product innovation of Cameroonian SMEs.
- H2. Islamic finance has positive and significant effects on the process innovation of Cameroonian SMEs.
- H3. Islamic finance positively and significantly affects the marketing innovation of Cameroonian SMEs.
- H4. Islamic finance positively and significantly affects the organizational innovation of Cameroonian SMEs.

It is worth noting here that to the best of our knowledge, this is the first study that links Islamic finance to the innovation capacity of enterprises. Thus this study will advance research in this direction by adopting a more holistic approach to innovation based on the four types of innovations (product, process, marketing, and organization) by employing two theoretical underpinnings: the Schumpeterian innovation model (Schumpeter, 1934) and the theory of financial intermediation (Gurley and Shaw, 1955, 1967) explained above.

### 3. Methodology

#### 3.1. Data source

The data for this study comes from a survey of 1358 Cameroonian SMEs that are users and non-users of Islamic finance. This design was deemed appropriate as survey design provides a useful method for generating primary data for model testing studies, as it is in this study, which is intended for generalization purposes (Hair, 2009). The survey covered eight out of the ten regions of Cameroon, making the sample representative of Cameroonian SMEs. The regions and the cities selected are based on many factors such as the percentage of Muslim population, number of banks, and number of enterprises to make the data collected more representative of the population for generalization purposes.

Non-random sampling techniques, particularly a purposive sampling technique and a quota sampling technique were used to collect the data, by a total of 11 surveyors who had experience in data collection with the use of Kobo collect software, the mobile version of the Kobotool box. The data collection ran for over three months (from January 9, 2023 to April 18, 2023). Out of 1543<sup>2</sup> questionnaires administered, 1358 useable questionnaires were obtained, representing a response rate of 88% which falls within the threshold of a “very good response rate” (Alderman and Salem, 2010).

### 3.2. Measurement of variables

#### 3.2.1. Dependent variable

For this study, our dependent variable is innovation. This variable is observed through a series of latent variables: process, product, marketing, and organizational innovations, making a total of four dependent variables captured using the items found in Appendix 1. These items contain information on whether an enterprise has introduced a new or significantly improved method of production, goods and services, marketing technique, or organizational methods. Each of the binary dependent variables is obtained by combining these items. Therefore, innovation indicators in this study are binary, coded 1 if the enterprise has introduced a given form of innovation and 0 if not. This approach to measuring innovation is based on the technique of the OECD, included in the Oslo Manual (2005) which is considered the most sound way of capturing innovative activity (Mairesse and Mohnen, 2010). This approach which has been especially applied in the European Union countries since 1992, has equally been used by empirical studies to measure innovation in less developed countries (Wendji and Kakeu, 2022).

#### 3.2.2. Independent variables

**Islamic finance:** To capture this, respondents were asked if they use or have recently used Islamic finance with usage being in terms of the adoption of the different Islamic finance products such as mudarabah, murabaha, salam, ijara, musharakah, qard hassan, and istisna which are the main products offered by Cameroonian financial institutions. Other follow-up questions like the type of product, name of bank, and the year the respondents benefitted from Islamic finance were equally asked. This variable is measured via a dummy variable that takes the value 1 if an enterprise uses Islamic finance and 0 if otherwise. The measurement is based on previous studies (Gonne and Mohamadou, 2022; Mahdzan et al., 2017). The control variables are defined as follows:

**Cooperation:** Cooperation with other firms leads to relational capital (Santos et al., 2014) thereby increasing the overall innovation level. Cooperation with consumers (lead users, co-producers of innovation) drives product innovation while cooperation with other partners is equally vital for innovation (Hewitt-Dundas, 2013; Temel et al., 2013). This variable is binary and is coded 1 if an enterprise has cooperated with at least one of the main partners of external knowledge (universities, research labs, consumers, and other enterprises) for the exchange of tacit and or codified knowledge and 0 if it has never cooperated. Universities, research labs, consumers, and other enterprises are considered the main sources of SME external knowledge for innovation (Kim and Lui, 2015).

**Competition:** this variable captures the level of competition faced by an enterprise based on whether it has other enterprises that sell similar products or render similar services in its vicinity. Competition is believed to be an important determinant of the innovative capacity of enterprises (Aghion et al., 2005). This variable is coded as a dummy taking the value 1 if an enterprise has competitors and 0 if otherwise.

**Size:** size does play an important role. Schumpeter (1934) theory argues that innovations normally start in the new and smaller firm and those that succeed grow into large firms. There is also evidence that small firms are more adaptable and have less rigid management structures given that they can easily carry out technological replacement at lesser costs, managing the tradeoff between explorative and exploitative innovation. This variable is a dummy variable that takes the value 1 if an enterprise has less than 10 employees and 0 if otherwise.

**Age of the enterprise:** the level of innovation does vary in function of enterprise age (Bouncken et al., 2021) since old enterprises are believed to possess more economies of scale than young ones. Since the average age of an enterprise in Cameroon is five years (NIS, 2016), this variable is binary, taking the value 1 if an enterprise is below or equal to 5 years old and 0 if above.

**Demand:** The dataset equally contains information on the geographic markets in which the enterprises sell goods or services with a distinction between local, and international services. “Demand” represents a dichotomous variable taking the value 1 if the enterprise produces goods and services for the local market and 0 if not, which makes it possible to take into account local and foreign markets since they can affect firm innovativeness (Aghion et al., 2018; Salomon and Shaver, 2005).

This study equally controls for the socio-demographic characteristics of the manager/owner since innovation can be affected by these factors (Daneji et al., 2019). **The gender** of the manager/owner is a dummy variable coded 1 for male and 0 for female; **marital status** also takes the value 1 for respondents that are single and 0 for those that are married; **the educational level** of the manager is coded 1 for no degree and 0 if at least First School Leaving certificate; also according to Cameroon’s youths policy, an individual is considered a youth if he/she falls below the age of 35. Thus to control for the **entrepreneur’s age**, a dummy variable is created taking the value 1 for those below 35 years and 0 for those above. Lastly, on the manager’s characteristics, we control for the degree of religiosity of the entrepreneur using the variable “**Religiosity**” which measures the frequency of church attendance. This variable takes the value 1 for those who go to church daily and 0 otherwise.

This study equally takes into consideration the effects of three contextual factors: the political instability in the country,<sup>3</sup> the COVID-19, and the Russia/Ukraine crises which have greatly impacted the Cameroonian economy. These crises affected SMEs through a drop in their sales revenue while in more severe cases, many SME owners ended up closing down their businesses or scaling down their workforce. This in turn can lead to a drop in the level of R&D expenditure and consequently the level of innovation capacity. To control for these crises in our model, three variables are created: **Political instability**, **COVID-19** (see Adam and Alarifi (2021)), and **the Russia/Ukraine war** (see Markus (2022)). **COVID-19** takes the value 1 if an enterprise indicated to have been negatively affected by the COVID-19 outbreak and 0 if otherwise. The same codification is done for the **Political instability** and the **Russia/Ukraine war** variables. The descriptive statistics of these variables are presented in Table 1.

Table 1 indicates that 9.8% of the enterprises surveyed have benefited from Islamic finance. The small number of enterprises using Islamic finance products is explained by the low penetration rate of Islamic finance in Cameroon which according to the Ministry of Finance stands at just 2%. As far as innovation is concerned, a majority of Cameroonian SMEs practice more non-technological innovation (marketing and organizational) than technological innovation (process and product). For instance, Table 1 indicates that while over 91% of the enterprises surveyed innovated from an organizational perspective, the figure remains lower for process innovation (44.6%). Equally 81.1% of

<sup>2</sup> The sample size was determined based on the formula developed by Cochran (1977) given by  $n = Z^2(P)(1 - P) / C^2$ , with Z being the z score; P proportion, and C confidence interval assumed to be 97.2%.

<sup>3</sup> Since 2016, the country has known a wave of political turmoil in the English-speaking regions which has had ramifications for the country as a whole.

**Table 1**  
Descriptive statistics.

Variable	Observations	Mean	Std. Dev.	Min	Max
Process innovation	1358	0.446	0.497	0	1
Product innovation	1358	0.604	0.489	0	1
Marketing innovation	1358	0.855	0.352	0	1
Organizational innovation	1358	0.915	0.28	0	1
Islamic finance	1358	0.098	0.297	0	1
Cooperate	1358	0.811	0.391	0	1
Competition	1358	0.94	0.237	0	1
Demand	1358	0.969	0.173	0	1
Size	1358	0.989	0.105	0	1
Enterprise age	1358	0.794	0.405	0	1
Marital status	1358	0.319	0.466	0	1
Gender	1358	0.593	0.491	0	1
Entrepreneur Age	1358	0.596	0.491	0	1
Educational level	1358	0.089	0.285	0	1
Religiosity	1358	0.248	0.432	0	1
Political instability	1358	0.783	0.413	0	1
COVID-19	1358	0.687	0.464	0	1
Russia/Ukraine war	1358	0.815	0.388	0	1

Source: Authors

the enterprises acknowledged to have cooperated either with other enterprises, consumers, or universities. It is also worth adding that only 23.3% of the surveyed units indicated to have ever filed for intellectual property rights. This speaks volumes of the nature of Cameroon’s national innovation system which is characterized by the implementation of minor incremental local innovation as a gross majority of the enterprises lack the financial prowess necessary for a more radical innovation. In terms of enterprise characteristics, small enterprises represent close to 99% of the total number of enterprises surveyed. In terms of age, most of the enterprises surveyed are equally below five years old. This further reveals the nature of the Cameroonian business landscape which is characterized by the dominance of very small enterprises, and low life expectancy of enterprises. Also, from a gender perspective, males seem to be dominant in the sample with 59.3% of our respondents while being well represented, females account for 40.7%. In terms of respondents’ age, it is those below 35 years (youths) that dominate our sample with 59.6% of the total sample size.

### 3.3. Empirical strategy

The multivariate probit model is adopted in this study given the system of four binary dependent variables representing the different forms of innovation. Unlike the simple probit and logit models where an enterprise can make only one choice (known as a "pick one") of the innovation activity that it implements, the multivariate model is ideal for a multi-category choice, permitting each enterprise to choose between several innovation activities. Thus the innovation activity becomes a basket made up of binary choices (yes/no, yes/no, etc.) according to the different types of innovation (innovation of product, process, organization, and marketing). In line with the previous literature (Egbetokun et al., 2019; Hajjem et al., 2015; Mairesse and Mohnen, 2010), this model is considered the most suitable for our analysis since applying a simple probit modeling on each of the innovation types would produce inconsistent estimators (Maddala, 1983).

When the dependent variable is binary, we have the following form

$$Y_i = \begin{cases} 1 & \text{if } Y^* > 0 \\ 0 & \text{if otherwise} \end{cases} \quad (1.1)$$

Whereby  $Y_i$  represents the non-observable dependent variables and  $Y^*$  is a latent variable that captures the observed and unobserved preferences associated with innovation capacity of SMEs. Specifically, applying this same logic in our case, we obtained the following equations:

$$\left\{ \begin{aligned} Pr_i &= \begin{cases} 1 & \text{if } Pr_i^* > 0 \\ 0 & \text{if otherwise} \end{cases} \quad \text{With } Pr_i^* = \beta_{pr} X'_{pr} + \epsilon_{ipr} \\ Pd_i &= \begin{cases} 1 & \text{if } Pd_i^* > 0 \\ 0 & \text{if otherwise} \end{cases} \quad \text{With } Pd_i^* = \beta_{pd} X'_{pd} + \epsilon_{ipd} \\ Mk_i &= \begin{cases} 1 & \text{if } Mk_i^* > 0 \\ 0 & \text{if otherwise} \end{cases} \quad \text{With } Mk_i^* = \beta_{mk} X'_{mk} + \epsilon_{imk} \\ Or_i &= \begin{cases} 1 & \text{if } Or_i^* > 0 \\ 0 & \text{if otherwise} \end{cases} \quad \text{With } Or_i^* = \beta_{or} X'_{or} + \epsilon_{ior} \end{aligned} \right. \quad (1.2)$$

Where  $Pr_i^*, Pd_i^*, Mk_i^*$ , and  $Or_i^*$  are the independent latent variables representing: process innovation, product innovation, marketing innovation, and organizational innovation respectively through which we can observe the level of innovation.  $X'$  Refers to the set of explicative variables which include: our variable of interest, "ISLAMICF" and the set of control variables.  $\beta_{pr}, \beta_{pd}, \beta_{mk}$ , and  $\beta_{or}$  are model parameters and  $\epsilon_{ipr}, \epsilon_{ipd}, \epsilon_{imk}$ , and  $\epsilon_{ior}$  are the error terms. Specifically, we estimate the following four equations presented in (1.3):

$$\left\{ \begin{aligned} Pr_i^* &= \beta ISLAMICF'_{ipr} + \alpha Z'_{ipr} + \epsilon_{ipr} \\ Pd_i^* &= \beta ISLAMICF'_{ipd} + \alpha Z'_{ipd} + \epsilon_{ipd} \\ Mk_i^* &= \beta ISLAMICF'_{imk} + \alpha Z'_{imk} + \epsilon_{imk} \\ Or_i^* &= \beta ISLAMICF'_{ior} + \alpha Z'_{ior} + \epsilon_{ior} \end{aligned} \right. \quad (1.3)$$

$ISLAMICF'_i$  is the variable of interest used to capture Islamic finance while  $Z'_i$  represents the set of control variables which include: cooperation, competition, size, export, age of enterprise, gender age of respondent, marital status, educational level, Political instability, COVID-19, and Russia/Ukraine war.  $\alpha$  and  $\beta$  are the parameters to be estimated by the maximum likelihood using the GHK (Geweke-Hajivassiliou-Keane) simulation method (Gates, 2006) while  $\epsilon_i$  are the error terms that jointly follow a multivariate normal distribution with zero conditional mean. The variance is normalized to unity, where  $(\mu_X; \mu_Z) \approx MVN(0, \Omega)$  and the symmetric variance-covariance matrix  $\Omega$  is specified by equation (1.4):

$$\Omega = \begin{pmatrix} 1 & \rho_{pd,pr} & \rho_{mk,pr} & \rho_{or,pr} \\ \rho_{pr,pd} & 1 & \rho_{mk,pd} & \rho_{or,pd} \\ \rho_{pr,mk} & \rho_{pd,mk} & 1 & \rho_{or,mk} \\ \rho_{pr,or} & \rho_{pd,or} & \rho_{mk,or} & 1 \end{pmatrix} \quad (1.4)$$

$\rho$  is the pairwise correlation coefficient of the error term concerning the different forms of innovation. The value of the correlation coefficient between the different forms of innovation further justifies the usage of a multivariate probit model.

The analysis of the interactions between the different types of innovation is deepened by highlighting the predicted probabilities resulting from the multivariate probit model (Cappellari and Jenkins, 2006). In the course of highlighting the predicted probabilities, attention is paid to the SMEs that use Islamic finance as a way of further identifying the enhancing effects of Islamic finance on the innovation capacity of Cameroonian SMEs. However, it is complex to directly obtain these marginal effects derived from models such as the multivariate probit whose order is at least equal to 3 (Mullahy, 2011). The calculation of the predicted probabilities is made possible by the STATA post-estimation command, *mvppred* (Cappellari and Jenkins, 2003). From the system of equation (1) of the multivariate Probit, the joint probability of observing an SME with a particular combination of values for the four dependent binary variables each is given by:

$$Pr(a, b, c, d; X) = Pr(pr = a, pd = b, mk = c, or = d) = \Phi_4[(2a - 1)X^{\beta_{pr}}, (2b - 1)X^{\beta_{pd}}, (2c - 1)X^{\beta_{mk}}, (2d - 1)X^{\beta_{or}}, \tilde{\Sigma}] \tag{1.5}$$

Where  $(a, b, c, d = 0, 1)$ ;  $\Phi_4$  is the Gaussian cumulative function of dimension 4 and  $\tilde{\Sigma}$  is the variance-covariance matrix defined by:

$$\tilde{\Sigma} = \begin{pmatrix} 1 & (2a - 1)(2b - 1)\rho_{pdpr} & (2a - 1)(2c - 1)\rho_{mkpr} & (2a - 1)(2d - 1)\rho_{orpr} \\ (2b - 1)(2a - 1)\rho_{pprd} & 1 & (2b - 1)(2c - 1)\rho_{mkpd} & (2b - 1)(2d - 1)\rho_{orpd} \\ (2c - 1)(2a - 1)\rho_{prmk} & (2c - 1)(2b - 1)\rho_{pdmk} & 1 & (2c - 1)(2d - 1)\rho_{ormk} \\ (2d - 1)(2a - 1)\rho_{pror} & (2d - 1)(2b - 1)\rho_{pdor} & (2d - 1)(2c - 1)\rho_{mkor} & 1 \end{pmatrix}$$

The post-estimation STATA command *mvpred* gives the predicted values of the four marginal probabilities of the estimated model:  $Pr(pr = 1)$ ,  $Pr(pd = 1)$ ,  $Pr(mk = 1)$ , and  $Pr(or = 1)$ . Similarly, this command allows us to estimate two joint probabilities  $Pr(pr = 1, pd = 1, mk = 1, or = 1)$  and  $Pr(pr = 0, pd = 0, mk = 0, or = 0)$  out of a total of eight joint probabilities in four dimensions (modalities) when the multivariate model is of order 4 (Cappellari and Jenkins, 2003). Therefore, it is necessary to resort to the manual calculation of the other eight predicted joint probabilities. It is also possible to estimate the conditional probabilities which describe, for example, the propensity of an enterprise to introduce a given type of innovation conditional on whether or not they have already introduced another type of innovation. The calculation of conditional probabilities can be formalized through the following equation (3):

$$Pr(pr = 1 | pd = 1) = \frac{\sum_c Pr(pr = 1, pd = 1, mk = 1, or = 1)}{\sum_{a,b,c,d} Pr(pr = a, pd = b, mk = c, or = d)} \tag{1.6}$$

With  $a, b, c, d = 1, 0$ .

## 4. Results and discussion of results

### 4.1. Results

Table 2 provides a comparative analysis between the users and the non-users of Islamic finance vis-à-vis their innovative capacity: process, product, marketing, and organization. Table 2 depicts that the innovative capacity of enterprises using Islamic finance is relatively higher than that of enterprises that are non-users, indicated by the positive mean difference between the two groups which has a 1% significance level. Table 2 equally indicates that this mean difference is higher when it concerns technological innovation (process and product) than non-technological innovation (marketing, and organization). This is

**Table 2**  
Mean comparison test between the users and the non-users of Islamic finance based on their innovative capacity.

Variables	Users (1)	Non-users (2)	Difference t-test 3 = 1-2
Process innovation	0.857 (0.030)	0.401 (0.014)	0.456***
Product innovation	0.895 (0.027)	0.572 (0.014)	0.322***
Marketing innovation	0.977 (0.013)	0.841 (0.010)	0.136***
Organizational innovation	0.992 (0.008)	0.906 (0.008)	0.086***

Source: Authors

justifiable due to the cost and the risk involved in technological innovation that is more manageable for users of Islamic finance given the participative nature of Islamic finance products, where the lender equally participates in the risk and shares ideas in the running of the business.

Table 3 presents the results of the Multivariate probit model with the

first part indicating the standard model's results which shows the correlations between the independent and dependent variables. This part equally permits us to validate the empirical approach as indicated by the coefficients of correlation and the values of the Wald chi2 test. The correlation coefficients between the error terms (rho) are all significant indicating interdependencies between the different forms of innovation while the Wald chi2 test is significant at 1% as well, validating the global significance of the model. The marginal effects are obtained using the *cmp* algorithm developed by Roodman (2011).

#### 4.1.1. Predicted probabilities of innovation capacity

Tables 4 and 5 below present the estimated values of the marginal, joint, and conditional probabilities of the adoption of the different forms of innovation. Further, the tables equally contain information on the probability of adopting different forms of innovation between the enterprises using Islamic finance and those that are non-users.

##### 4.1.1.1. Robustness analysis

4.1.1.1.1. Robustness analysis accounting for different innovation proxies. The first part of our sensitivity analysis is concerned with using different measures of SME innovation capacity that are well documented in the innovation capacity literature. The two measures are R&D expenditure and patents. R&D expenditure is considered the oldest measure of innovation and is particularly focused on innovation efforts (Gault and von Hippel, 2009). On the other hand, patenting is considered the most employed measure of innovation by countries since it permits a better comparison of the level of innovation based on geography. It is concerned with the output aspect of the innovation process, especially product innovation (Reeb and Zhao, 2020). R&D expenditure is measured by a dichotomous variable which takes the value 1 if an enterprise has spent for research and development and 0 if otherwise. Patent is equally captured in the same way with 1 representing SMEs that have ever applied to protect their invention and 0 for otherwise.

The results with the application of these two measures are presented in Table 6 with two probit models. The univariate model is the model without marginal effects. However, even though the coefficients in a standard probit model lack any econometric interpretation, their signs can be observed to get an understanding of the nature of the effects of our independent variables on the dependent variables. For example, the signs of the Islamic finance variable are positive for R&D expenditure and negative for patents, thereby indicating a possible positive effect on R&D expenditure and a negative effect on patents. However, the *mfx* STATA post-estimation permits us to obtain the marginal effects which indicate the degree of variation of the dependent variable following a unit change in the independent variable, as shown by the second model of Table 6. Equally, the standard errors reported in Table 6 (just like in Tables 3 and 7) are considered robust following the specification of the STATA command extension, *vce(robust)* described as the White/Sandwich/Huber estimator used in dealing with the potential problem of

**Table 3**  
Effects of Islamic finance on the innovation capacity of Cameroonian SMEs (Multivariate probit).

VARIABLES	Standard Multivariate				Multivariate with marginal effects			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
	Process innovation	Product innovation	Marketing innovation	Organizational innovation	Process innovation	Product innovation	Marketing innovation	Organizational innovation
Islamic finance	1.170*** (0.151)	0.836*** (0.167)	1.152*** (0.240)	1.058*** (0.357)	0.395*** (0.0406)	0.220*** (0.0375)	0.129*** (0.0236)	0.0229 (0.0153)
Cooperate	0.413*** (0.101)	0.570*** (0.0970)	0.832*** (0.108)	1.321*** (0.124)	0.139*** (0.0335)	0.210*** (0.0342)	0.241*** (0.0325)	0.291*** (0.0299)
Competition	-0.332** (0.158)	0.198 (0.152)	0.361** (0.173)	0.367* (0.201)	-0.118** (0.0566)	0.0754 (0.0524)	0.120** (0.0485)	0.121*** (0.0462)
Demand	-0.648*** (0.205)	-0.386 (0.237)	-0.725** (0.311)	-0.651 (0.447)	-0.215*** (0.0667)	-0.130* (0.0681)	-0.102*** (0.0373)	-0.0939*** (0.0363)
Size	-0.786* (0.435)	-1.055** (0.538)	-3.763*** (0.176)	0.384 (0.502)	-0.177** (0.0848)	-0.164** (0.0729)	-0.0701** (0.0292)	0.0538 (0.0681)
Enterprise age	-0.291*** (0.0957)	-0.374*** (0.102)	-0.142 (0.128)	-0.0761 (0.145)	-0.106*** (0.0337)	-0.127*** (0.0321)	-0.0304 (0.0262)	-0.0209 (0.0193)
Marital status	-0.118 (0.0880)	-0.0183 (0.0875)	-0.226** (0.110)	-0.0860 (0.131)	-0.0445 (0.0318)	-0.0146 (0.0321)	-0.0418* (0.0222)	-0.0175 (0.0171)
Gender	0.0963 (0.0751)	0.114 (0.0749)	-0.0297 (0.0951)	0.0985 (0.114)	0.0369 (0.0274)	0.0437 (0.0273)	-0.00415 (0.0183)	0.0178 (0.0153)
Age of entrepreneur	0.0111 (0.0849)	-0.264*** (0.0852)	0.237** (0.113)	0.0798 (0.137)	0.0116 (0.0309)	-0.0874*** (0.0299)	0.0329 (0.0204)	0.00456 (0.0151)
Educational level	-0.110 (0.128)	0.0102 (0.140)	-0.273* (0.156)	0.0718 (0.212)	-0.0481 (0.0459)	0.0102 (0.0472)	-0.0607 (0.0391)	0.0370 (0.0248)
Religiosity	0.165* (0.0923)	0.173* (0.0946)	-0.115 (0.115)	0.131 (0.171)	0.0568* (0.0342)	0.0586* (0.0327)	-0.0179 (0.0239)	0.0238 (0.0177)
Political instability	-0.145 (0.106)	-0.00910 (0.106)	-0.447*** (0.155)	-0.207 (0.191)	-0.0552 (0.0407)	-0.00278 (0.0380)	-0.0701*** (0.0194)	-0.0266 (0.0163)
COVID-19	-0.0687 (0.0921)	-0.0889 (0.0931)	-0.402*** (0.122)	-0.211 (0.176)	-0.0222 (0.0345)	-0.0304 (0.0341)	-0.0733*** (0.0191)	-0.0328** (0.0161)
Russia/Ukraine war	0.00484 (0.112)	-0.111 (0.112)	4.13e-05 (0.157)	0.398** (0.166)	0.00268 (0.0422)	-0.0441 (0.0399)	0.000725 (0.0218)	0.0445** (0.0187)
Constant	1.475*** (0.490)	1.497** (0.582)	5.332*** (0.416)	0.346 (0.680)				
Observations	1358	1358	1358	1358	1358	1358	1358	1358
Wald chi2	3447	3447	3447	3447	658.1	658.1	658.1	658.1
Log(pseudo likelihood)	-2275	-2275	-2275	-2275				
Correlation coefficient	rho21 = 0.366*** rho31 = 0.391*** rho41 = 0.359*** rho32 = -0.346*** rho42 = 0.620*** rho43 = 0.618***							
Likelihood ratio test of rho21 = rho31 = rho41 = rho32 = rho42 = rho43 = 0:	Prob > chi2 = 0.000							

Robust standard errors in parentheses \*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1.  
Source: Author

heteroskedasticity (White, 1980) that may arise because of measurement error as it relaxes the independent and identically distributed assumptions (Williams, 2020).

4.1.1.1.2. *Robustness analyses employing a global measure of innovation.* From the four types of innovation employed to capture innovation in this study, the global innovation indicator (INNOVG) was computed. The reason behind this is to understand if the effects of Islamic finance on innovation are consistence with innovation taken wholly. This indicator which is the sum of the four types of innovation is a dummy variable that is coded 1 if an SME has introduced at least one form of innovation and 0 otherwise. A simple probit model is used to model these relationships and the results in Table 7 are displayed.

#### 4.2. Discussion of results

Table 3 presents the main results of the multivariate probit model. The marginal effects indicate that Islamic finance enhances the innovation capacity of Cameroonian Small and Medium enterprises. Specifically, there exists a positive and significant effect (at a 1% threshold) of Islamic finance on process innovation, product innovation, and marketing innovation. While the effects on organizational innovation are positive but statistically insignificant. An increase in Islamic finance usage by a unit will bring about a 49.5%, 22%, and 12.9% increase in the probability that an SME introduces process innovation, product innovation, and marketing innovation respectively. The results equally indicate that the effects of Islamic finance on SME innovation in Cameroon are more pronounced on technological innovation (process

**Table 4**  
Some marginal and joint probabilities (in %ages).

Variable	Overall	Users	Non-users
<b>Marginal probabilities</b>			
Pr(PR = 1)	44.60	85.44	40.16
Pr(PD = 1)	60.24	89.36	57.09
Pr(MK = 1)	85.53	98.19	84.15
Pr(OR = 1)	91.37	99.534	90.48
<b>Joint probabilities</b>			
Pr(PR = 1, PD = 1, MK = 1, OR = 1)	32.47	77.71	27.6
Pr(PR = 1, PD = 1, MK = 1, OR = 0)	0.24	0.15	0.24
Pr(PR = 1, PD = 1, MK = 0, OR = 1)	1.00	0.72	1.00
Pr(PR = 1, PD = 0, MK = 1, OR = 1)	0.40	0.10	0.40
Pr(PR = 0, PD = 1, MK = 1, OR = 1)	8.48	6.58	8.70
Pr(PR = 1, PD = 1, MK = 0, OR = 0)	0.70	0.10	0.70
Pr(PR = 1, PD = 0, MK = 1, OR = 0)	1.26	0.20	1.40
Pr(PR = 1, PD = 0, MK = 0, OR = 1)	0.14	0.10	0.15
Pr(PR = 0, PD = 1, MK = 1, OR = 0)	21.65	10.31	22.89
Pr(PR = 0, PD = 1, MK = 0, OR = 1)	1.22	0.10	1.35
Pr(PR = 0, PD = 0, MK = 1, OR = 1)	2.90	0.39	3.16
Pr(PR = 1, PD = 0, MK = 0, OR = 0)	0.44	0.10	0.50
Pr(PR = 0, PD = 0, MK = 1, OR = 0)	18.4	3.23	20.02
Pr(PR = 0, PD = 0, MK = 1, OR = 0)	2.42	0.15	2.67
Pr(PR = 0, PD = 0, MK = 0, OR = 1)	5.30	0.38	5.79
Pr(PR = 0, PD = 0, MK = 0, OR = 0)	4.20	0.10	4.59

Notes: PR = process innovation; PD = product innovation; MK = marketing innovation; OR = organizational innovation.

Source: authors

**Table 5**  
Some conditional probabilities (in %ages).

Variable	Overall	Users	Non-users
<b>Conditional probabilities</b>			
Pr(PR = 1 PD = 1)	53.44	87.64	49.72
Pr(PR = 1 MK = 1)	47.82	85.96	43.68
Pr(PR = 1 OR = 1)	46.48	85.59	42.24
Pr(PD = 1 PR = 1)	72.77	91.66	70.72
Pr(PD = 1 MK = 1)	63.80	89.80	60.98
Pr(PD = 1 OR = 1)	62.40	89.51	59.46
Pr(PR = 1 PD = 1, MK = 1)	55.48	87.98	51.95
Pr(PR = 1 PD = 1, OR = 1)	54.55	87.73	50.95
Pr(PR = 1 MK = 1, OR = 1)	49.29	86.08	45.29
Pr(PD = 1 PR = 1, MK = 1)	74.47	91.90	72.58
Pr(PD = 1 PR = 1, OR = 1)	73.75	91.73	71.80
Pr(PD = 1 MK = 1, OR = 1)	65.39	89.91	62.73
Pr(MK = 1 PR = 1, PD = 1)	94.57	99.06	94.09
Pr(MK = 1 PR = 1, OR = 1)	93.16	98.84	92.55
Pr(MK = 1 PD = 1, OR = 1)	91.82	98.71	91.07
Pr(OR = 1 PR = 1, PD = 1)	97.18	99.81	96.90
Pr(OR = 1 PR = 1, MK = 1)	96.65	99.77	96.31
Pr(OR = 1 PD = 1, MK = 1)	96.05	99.75	95.65
Pr(PR = 1 PD = 1, MK = 1, OR = 1)	57.14	87.99	53.79
Pr(PD = 1 PR = 1, MK = 1, OR = 1)	76.13	91.90	74.41
Pr(MK = 1 PR = 1, PD = 1, OR = 1)	96.30	98.71	96.01
Pr(OR = 1 PR = 1, PD = 1, MK = 1)	98.99	99.01	98.91

Notes: PR = process innovation; PD = product innovation; MK = marketing innovation; OR = organizational innovation.

Source: authors

and product innovation) than non-technical innovation (marketing and organizational innovation). These results confirmed our first, second, and third hypotheses according to which Islamic finance positively and significantly explains process, product, and marketing innovations. The role of finance in enterprise innovation is extensively studied in the

**Table 6**  
Robustness analyses taking into account different innovation proxies.

VARIABLES	Univariate probit		Probit with marginal effects	
	(1)	(2)	(1)	(2)
	R&D expenditure	Patents	R&D expenditure	Patents
Islamic finance	0.594*** (0.143)	-0.455** (0.193)	0.233*** (0.054)	-0.103** (0.043)
Cooperate	0.980*** (0.128)	0.815*** (0.158)	0.332*** (0.034)	0.184*** (0.035)
Competition	-0.0697 (0.166)	-0.529*** (0.188)	-0.027 (0.065)	-0.120** (0.042)
Demand	0.184 (0.252)	-0.360* (0.189)	0.070 (0.093)	-0.081* (0.042)
Size	-1.112*** (0.411)	-0.513 (0.361)	-0.401*** (0.111)	-0.116 (0.082)
Enterprise age	0.284*** (0.107)	0.786*** (0.151)	0.108** (0.040)	0.178*** (0.033)
Marital status	-0.162 (0.0987)	-0.604*** (0.108)	-0.063* (0.038)	-0.137*** (0.024)
Gender	-0.0913 (0.0814)	0.0421 (0.0884)	-0.036 (0.032)	0.010 (0.020)
Age of entrepreneur	-0.0105 (0.0943)	0.220** (0.0984)	-0.004 (0.037)	0.050** (0.022)
Educational level	-0.127 (0.150)	-0.620*** (0.234)	-0.049 (0.057)	-0.140** (0.052)
Religiosity	-0.0996 (0.102)	-0.0654 (0.111)	-0.039 (0.039)	-0.015 (0.025)
Political instability	-0.0342 (0.120)	0.472*** (0.128)	-0.013 (0.047)	0.107*** (0.029)
COVID-19	-1.251*** (0.0975)	-1.157*** (0.108)	-0.468*** (0.032)	-0.262*** (0.021)
Russia/Ukraine war	-0.160 (0.126)	0.177 (0.134)	-0.063 (0.050)	0.040 (0.030)
Constant	0.863* (0.481)	-0.474 (0.422)		
Observations	1358	1358		
Log(pseudo likelihood)	-696.4	-547.9		
LR chi2	350.2	270.9		
Pseudo R2	0.251	0.257		

Robust standard errors in parentheses \*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1.

Source: Authors

literature dating back to Schumpeter (1934) who stated that the financial system favors the financing of innovative enterprises permitting them to carry out “new combinations”. From an empirical angle, studies such as those of Rathnayake et al. (2022) and Xiong et al. (2023) have equally emphasized this role. The findings of Rathnayake et al. (2022) though focused on the conventional financial system still confirmed the role bank credit plays in enhancing enterprise innovation. In support of the findings obtained in this study, Xiong et al. (2023) showed that digital financial inclusion increases the innovative capacity of enterprises though the above study measured innovation using enterprise R&D expenditure which only captures innovation efforts as opposed to commercialized inventions. The positive effects of Islamic finance on these forms of Innovation stem from the fact that Islamic finance promotes the inclusivity of SMEs, considered “unbankable” by the conventional banking system through its zero-interest principle which provides the necessary financial resources for SME R&D activities thereby increasing their ability to produce new knowledge and to absorb existing knowledge. Another possible channel through which Islamic finance can enhance innovation is through its ability to take part in the running of the businesses through its participative principle, giving more room for

**Table 7**  
Robustness analyses employing a global measure of innovation.

VARIABLES	Univariate probit				Probit with marginal effects			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
	INNOVG	INNOVG	INNOVG	INNOVG	INNOVG	INNOVG	INNOVG	INNOVG
Islamic finance	1.277*** (0.364)	1.180*** (0.389)	1.179*** (0.401)	1.225*** (0.390)	0.117*** (0.012)	0.082*** (0.011)	0.079*** (0.011)	0.074*** (0.010)
Cooperate		1.317*** (0.108)	1.269*** (0.109)	1.205*** (0.113)		0.300*** (0.033)	0.281*** (0.033)	0.250*** (0.033)
Competition		0.441*** (0.170)	0.468*** (0.172)	0.446** (0.180)		0.078 (0.038)	0.082** (0.039)	0.073** (0.038)
Demand		-0.748** (0.329)	-0.700** (0.320)	-0.685** (0.327)		-0.060*** (0.01)	-0.056*** (0.014)	-0.051*** (0.014)
Size		0.395 (0.550)	0.417 (0.551)	0.342 (0.563)		0.070 (0.121)	0.073 (0.122)	0.054 (0.109)
Enterprise age		-0.107 (0.134)	-0.0428 (0.139)	-0.130 (0.141)		-0.014 (0.016)	-0.006 (0.018)	-0.015 (0.015)
Marital status			-0.276** (0.119)	-0.196 (0.121)			-0.039** (0.018)	-0.025 (0.017)
Gender			0.0678 (0.105)	0.0504 (0.107)			0.009 (0.014)	0.006 (0.013)
Age of entrepreneur			-0.0420 (0.127)	-0.0523 (0.130)			-0.005 (0.017)	-0.006 (0.016)
Educational level			-0.0652 (0.193)	-0.0203 (0.193)			-0.009 (0.028)	-0.003 (0.024)
Religiosity			-0.0111 (0.148)	0.0266 (0.149)			-0.001 (0.020)	0.003 (0.018)
Political instability				-0.258* (0.152)				-0.028** (0.015)
COVID-19				-0.500*** (0.141)				-0.054*** (0.014)
Russia/Ukraine war				0.0550 (0.158)				0.007 (0.020)
Constant	1.155*** (0.0460)	0.294 (0.585)	0.285 (0.586)	1.007 (0.660)				
Observations	1358	1358	1358	1358				
LR chi2	12.30	193.7	198.5	222.7				
Log(pseudo) likelihood	-465.2	-375.6	-371.5	-361.1				
Pseudo R2	0.0269	0.214	0.223	0.245				

Robust standard errors in parentheses \*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1.  
Source: authors

monitoring and sharing of expertise. This, in turn, favors the creation and diffusion of new knowledge with the enterprises less pressurized since both parties participate in the risk as well as the gains of the business (Masrizal and Trianto, 2022). Lastly, the asset-based contracts of Islamic finance (based on salam, ijara, and murabaha products) increase the volume and variety of goods sold by SMEs which can foster, especially product innovation.

As far as our controls are concerned, the results indicate that cooperation positively and significantly affects all four types of innovation practiced by Cameroonian SMEs. This result is in line with those of previous studies (Wendji and Kakeu, 2022) and underlines the role played by knowledge from partners such as producers, and competitors in the innovation drive of enterprises as was justified by Porter (1990) according to which in a given cluster, firms tend to cooperate and share useful knowledge that ends up impacting their innovation performance. Also, the effects of competition are seen to be mixed regarding the four types of innovation. While the effects on process innovation are negative, the effects on organizational and marketing innovations are positive. This can be justified by the fact that process innovation is considered more important by enterprises when it comes to their performance than the other forms and in effect, is kept secret by these enterprises, unlike marketing and organizational innovations that are less costly and more open, difficult to keep from the eyes of the competitors. These results are similar to those obtained by previous studies such as

that of Alsharkas (2014). Also, selling in a local market contributes negatively to the ability to innovate unlike selling in a foreign market (Salomon and Shaver, 2005). Size exerts a negative and significant effect on process, product, and marketing innovation while the effects on organizational innovation are insignificant. This result means that being a small enterprise reduces the propensity to innovate and contradicts the view that innovation starts with small firms (Schumpeter, 1934) in favor of the proponents of the idea that larger enterprises are more likely to engage in innovative ventures since they have the resources necessary for R&D (Aristizabal et al., 2015; Fishman and Rob, 1999), while enterprise age negatively affects innovation, these results are only significant for process and product innovation meaning that the fact that an enterprise is below five years reduces its probability of carrying out process and product innovations.

The next group of control variables is based on the socio-demographic characteristics of the owners/managers. The results in Table 3 show that being single reduces the probability of innovating especially for marketing innovation signifying the role of the household partner in the sharing of ideas for innovation. The educational level variable indicates that managers/owners that do not hold at least an elementary educational level have a lower probability of innovating particularly for marketing innovation, thereby confirming the role of literacy level on the creation of new knowledge (Jiang et al., 2023). The religiosity of the entrepreneur measured by the frequency of church

service attendance equally exerts a positive and significant effect on product and process innovations. This result contradicts the popular view that religiosity beyond a certain scale negatively affects entrepreneurship (Barro and McCleary, 2003) and shows that there is a possibility of benefitting from social capital even in places of worship.

This study equally controlled for the negative effects of the political instability, COVID-19 pandemic, and the current crises between Russia and Ukraine on the innovative drive of Cameroonian SMEs since these crises have and are still having severe economic ramifications locally. Results show that the political crisis negatively affects the innovation capacity of Cameroonian SMEs, with the results being significant only for marketing innovation. This confirms the findings of previous studies according to which political instability negatively affects corporate innovation (Díaz-Díaz et al., 2022; Krammer and Kafouros, 2022). The COVID-19 pandemic though having negative effects on innovation capacity, remains statistically insignificant for organizational and marketing innovations. Lastly, the Russia/Ukraine war has a positive and significant effect on the probability of implementing organizational innovation only as the effects on the types of innovation are insignificant. These results further underline the gravity of these crises that have affected the real sector enormously especially the COVID-19 pandemic (Fernandes, 2020).

The first quadrant of Table 4 presents the results of the marginal probabilities which indicate the probability that an SME adopts a given type of innovation irrespective of other innovation types. Considering the overall sample, it is organizational innovation that presents the highest marginal probability (91%) as opposed to the other types of innovations. Irrespective of innovation types, SMEs that use Islamic finance are seen to have a higher probability of adopting a given innovation type taken individually than those that are non-users. The second quadrant corresponds to the results of the joint probabilities, which indicate the probability that an enterprise adopts a combination of at least two innovation types. From these probabilities, the probability that an SME adopts all four types of innovation is 32.47% for the overall sample, 77.71% for users of Islamic finance, and 27.6% for non-users of Islamic finance. In terms of the implementation of no form of innovation, it is observed that the probability is lower for SMEs that use Islamic finance than the non-users. The above results further underline the role played by Islamic finance in enhancing the innovation capacity of SMEs as already discussed previously. Table 5 contains the results of the conditional probabilities that is the probability that an SME adopts a particular type of innovation given that it has already adopted other types of innovation. The highest conditional probability for the combination of two innovation types is 72.77%, corresponding to process and product innovation. This probability is equally higher for Islamic finance users (91.66%) than the non-users (70.72%). The highest probability of the combination of all four types of innovation is 98.99% corresponding to the probability of adopting organizational innovation given that the SME has already adopted all the other three types of innovation. Just as in previous cases, this probability is higher for users of Islamic finance than the non-users.

Table 6 provides the results of our robustness analysis while considering two alternative measures of innovation capacity which are well documented in the innovation literature, R&D expenditure, and patents applications. In terms of R&D expenditure, the results are consistent with the main results further highlighting the role played by Islamic finance when it comes to entrepreneurship. The results considering patents as a measure of innovation show that Islamic finance negatively and significantly affects the probability that an SME files for intellectual property rights. A possible justification is that an exorbitant sum of money is needed to file for intellectual property rights in

Cameroon (about 750USD).<sup>4</sup> This is however considered costly and out of the reach of most Cameroonian SMEs. This means that even if Islamic finance encourages the innovation capacity of SMEs, the high cost relating to patent applications in the context of Cameroon can hinder enterprises from filing for intellectual property rights. The second robustness analysis involves the employment of a global innovation indicator (Table 7) derived based on the four types of innovation. The results of the simple probit model with marginal effects confirm our main results that Islamic finance positively and significantly contributes to the innovation capacity of Cameroonian SMEs. The results of the control variable are more or less the same.

## 5. Conclusion and policy implications

This study assessed the effects of the Islamic mode of financing on the innovation capacity of Cameroonian SMEs using data from a survey of 1358 enterprises in eight different regions of Cameroon. The data were analyzed using a multivariate probit model. The main results of the study indicate that Islamic finance enhances the ability of Cameroonian SMEs to innovate. Specifically, there exists a positive and significant effect of Islamic finance on process innovation, product innovation, and marketing innovation. While the effects on organizational innovation are positive, they remain statistically insignificant. Our main results equally indicate that the effects of Islamic finance on the innovation capacity are more pronounced for technological innovation (process and product innovations) than non-technological innovation (marketing and organizational innovations). The role played by Islamic finance is further highlighted by the predicted probabilities which show that SMEs using Islamic finance have a higher propensity of introducing and combining different types of innovation than those that are non-users. Our robustness analyses based on a simple probit model permitted us to employ a global measure of innovation and other measures of innovation capacity that are frequently employed in the literature. The results of the robustness analyses based on R&D expenditure and the global innovation indicator validate our main findings according to which Islamic finance enhances the innovation capacity of Cameroonian SMEs. The robustness checks also show that Islamic finance negatively and significantly affects patent applications by Cameroonian SMEs.

From a policy perspective, policymakers are encouraged to put in place the necessary mechanisms for the promotion of Islamic finance such as the enacting of laws that ensure the creation of full-fledged Islamic banks, encouraging research in Islamic finance and Islamic economics, and creating awareness about the benefits and specificities of this mode of finance to enhance the innovation of SMEs. In the quest to improve the innovation ability of these enterprises, there is equally the need to take into account the possible synergy that exists between the different types of innovation such as between process and product innovations. There is equally the need to put in place favorable legal conditions that make the cost of filing for intellectual property rights within the reach of SMEs to reverse the negative effects of the Islamic mode of financing on SMEs' ability to file for patents.

Future studies in this area of research can consider a more reliable measure of Islamic finance such as the volume of Islamic finance credit, the number of Islamic finance products used by SMEs, etc as a way of overcoming one of the weaknesses of this study, which is that of measuring Islamic finance using a dummy variable. Future research can equally consider the role played by transmission channels such as ICT and organizational culture in modulating the effects of Islamic finance on SMEs' probability to innovate, an aspect not taken into account in the present study.

<sup>4</sup> See <https://www.investiraucameroun.com/economie/1701-17380-propriete-intellectuelle-l-oapi-baisse-de-10-et-20-les-couts-de-protection-des-marques-en-2022>.

### Appendix 1. Construction of process, product, marketing, and organization innovation variables

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**Process innovation**

Between 2020 and 2022 has your business introduced a new or significantly improved process of production of goods and services or the rendering of services? (1 = yes; 0 = no)

Between 2020 and 2022 has your business introduced new or significantly improved methods of logistics, maintenance, furniture, or the distribution of raw materials, goods, or the rendering of services? (1=yes; 0=no)

**Product innovation**

Between 2020 and 2022 has your business introduced new products or improved the appearance of existing products? (1 = yes; 0 = no)

Between 2020 and 2022 has your business introduced significant modifications of the appearance of your products? (1 = yes; 0 = no)

**Organizational innovation**

Between 2020 and 2022 has your business introduced new modes of operation in the organisation of management and supply procedures? (1 = yes; 0 = no)

Between 2020 and 2022 has your business introduced new methods of work organization and decision-making? (1 = yes; 0 = no)

Between 2020 and 2022 has your business introduced new ways of organizing external relations with other companies or organisations? (1 = yes; 0 = no)

**Marketing innovation**

Between 2020 and 2022 has your business used new communication techniques and media to reach clients and potential clients? (1 = yes; 0 = no)

Between 2020 and 2022 has your business introduced new methods (or significant changes in methods) of sale or distribution? (1 = yes; 0 = no)

Between 2020 and 2022 has your business introduced new pricing strategies for your products? (1 = yes; 0 = no)

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Source: authors.

Appendix 2. Matrix of correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
1. Process innovation	1.000																	
2. Product innovation	0.317	1.000																
3. Marketing innovation	0.247	0.256	1.000															
4. Organizational innovation	0.200	0.345	0.488	1.000														
5. Islamic finance	0.273	0.196	0.115	0.092	1.000													
6. Cooperate	0.129	0.191	0.320	0.432	0.108	1.000												
7. Competition	-0.031	0.063	0.135	0.179	0.073	0.189	1.000											
8. Demand	-0.088	-0.049	-0.037	-0.024	-0.013	0.066	0.081	1.000										
9. Size	-0.090	-0.071	-0.044	-0.007	-0.084	-0.051	0.092	0.103	1.000									
10. Enterprise age	-0.100	-0.119	0.033	0.027	-0.065	0.122	0.095	0.046	0.120	1.000								
11. Marital status	-0.105	-0.121	-0.104	-0.102	-0.093	-0.139	0.026	0.086	0.057	0.122	1.000							
12. Gender	0.083	0.092	-0.009	0.047	0.137	-0.005	0.019	-0.018	-0.045	-0.063	0.004	1.000						
13. Entrepreneur Age	-0.074	-0.152	0.006	-0.032	-0.122	-0.017	0.046	0.044	0.013	0.270	0.467	-0.103	1.000					
14. Educational	-0.015	0.026	-0.077	0.022	0.027	-0.061	0.013	0.041	0.008	-0.077	-0.025	0.112	-0.106	1.000				
15. Religiosity	0.161	0.148	0.024	0.096	0.401	0.076	0.058	-0.006	-0.021	-0.086	-0.122	0.261	-0.110	0.167	1.000			
16. Political instability	-0.027	-0.021	-0.141	-0.059	0.095	-0.076	-0.042	-0.012	-0.022	-0.088	0.050	0.007	-0.012	0.014	0.071	1.000		
17. COVID-19	-0.005	-0.024	-0.179	-0.110	0.153	-0.183	-0.029	0.026	-0.026	-0.214	0.155	0.064	-0.029	0.072	0.138	0.461	1.000	
18. Russia/Ukraine war	-0.008	-0.037	-0.105	-0.017	0.087	-0.084	-0.040	0.014	-0.050	-0.102	0.049	0.018	-0.017	0.022	0.054	0.545	0.440	1.000

Source: Authors.

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