A Comparative Analysis of the Determinants of Innovation Behaviour Between Cameroon, Cote d'Ivoire and Senegal[1]

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Abstract

As a result of the globalization shock, the new world economic vision and competition from new emerging markets, industrialized countries are shifting their production towards more sophisticated goods with a high technological content and make innovation capacity the main element of international competition. In this new era, the economic systems of developing countries are under increasing pressure characterized by the complexity of cross-border networks and trade flows. Thus, the integration of the race to innovation through the acquisition of these technological and non-technological flows by companies then becomes a vital issue in order to close this gap. This study highlights the determinants of innovation behavior in three French speaking Sub-Sahara African countries (Cameroon, Senegal and the Ivory Coast) based on data from the «The Determinants of the Business Performance in French Sub-Saharan Africa: The Case of Cameroon, the Ivory Coast and Senegal» carried out in 2014 in the three target countries with the collaboration of the International Development Research Center (IDRC).

The econometric analysis using a Tobit II type model shows that the main determinants of the innovation behavior of firms are: market impulse, technological impulse, competition pressure, inter-firm cooperation, the use of ICT, and the abilities of the entrepreneur in the management of innovation activities. However, Cameroonian companies unlike the others, rely much more on information from the market and the group they belong to in order to engage in innovation activities. On the other hand, those of Senegal are more engaged in innovation activities if they are under international competition pressure. As for those of the Ivory Coast which are the victims of the post-election crisis of 2011, they use only their personal funds to finance innovation activity and generally engage in these innovation activities according to the security of the business environment and social protection of intellectual property.

Keyword: French Sub-Saharan Africa, behaviour, enterprise, innovation

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Introduction

The new world economic vision and competition from new emerging markets direct the production objectives of industrialized countries towards more sophisticated goods with high technological content and the capacity of innovation, the main element of international competition. In this new era, economic systems are under an increasing pressure characterized by the complexity of cross-border network flows of knowledge, ideas and technology. The integration of the race to innovation by the acquisition of these flows of technology and new knowledge then becomes a vital question for companies and nations, in order to close the gap. The determination of growth paths through the circulation of these flows is drawing a new configuration of the poles of innovation in the world, with Africa in general and French-speaking Sub-Saharan Africa in particular being the continent of the future. Given the strategic position that these countries occupy in the future, they need to find new sources of growth. This quest for new sources of growth in a period where many countries are confronted to the decreasing returns to the labor factor and investment in physical capital must consequently be more and more ensured by gains in productivity which is acquired through innovation. Innovation is thus essential in enabling developing countries and businesses to escape recession and prosper in a highly competitive and reticular world economy. It is thus on this powerful engine of development that «economies on the path to emergence» should count on to create jobs and stimulate the growth of productivity through the creation, use and diffusion of knowledge.

In fact, for millennia, economic progress in Sub-Saharan Africa (SSA) was extremely slow because progress was often counterbalanced by increase in population growth, war and epidemics. However, because of the conjunction of events which were the subject of debate in the previous decade, these countries designed policies of emergence in order to start-up the growth process. One of the paradoxes of this decade is that Sub-Saharan Africa (SSA) recorded an unprecedented growth (6%) but a large part of its population lives in economic poverty, suffers from unemployment and inequality. This is because industrialization contributed only a meager share (12%) to economic growth (BAD, 2014). This lack of coherence is exacerbated by the inability of the majority of African economies to transform their structure. Given the progress in economic growth in SSA and the studied countries, we can question ourselves if the resources of Africa are able to support the almost vertical growth path almost shown in figure 1 since 2010, given that this growth concerns several billion individuals who are still at the start-up point of the policies of emergence. What is certain is that these conditions will now; more than ever put SSA in the face of the challenge of using its capacities of innovation and adaptation. The improvement of the processes of innovation should stimulate growth in SSA through an increase in productivity and an improvement in competitiveness. To transform this high economic growth into sustained inclusive development, African countries must

bring the strategies of innovation that favor economic diversification, making it possible to create jobs and reduce inequality and poverty.

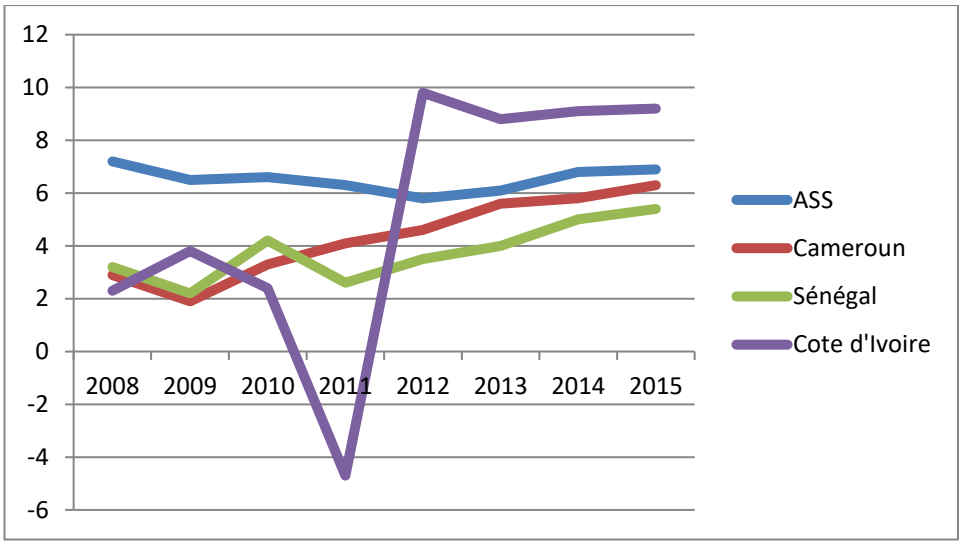

Figure 1: evolution of economic growth in Sub-Saharan Africa
Source: ADB, 2014

Innovation being the main element behind productivity growth (Krugman, 1990), is of a particular importance for companies, not only because it is often at the heart of the success of large companies, but also because the creation of new products and the improvement of the efficiency of processes constitute the main approach for companies to strengthen their competitiveness. This determinant of growth is the subject of debate since the theory of division of the labour of Adam Smith and the theory of the mechanization of Ricardo, to the new theories of growth, passing through the theory of creative destruction of Schumpeter.

While many studies throughout the world hold that innovation is a significant source of growth for companies, there are not enough studies on the practices of innovation in companies and their determinants in French-speaking Sub-Saharan Africa. This study tries to fill this gap by having as objective, to make a comparative analysis of the determinants of the behavior of innovation between three countries (Cameroon, Senegal and the Ivory Coast) in French-speaking Sub-Saharan Africa. The rest of this study is articulated around four sections. The first presents the theoretical bases of innovation, the second presents the existing literature on innovation, the third presents the methodology of the study. The fourth section examines the results.

1. Theoretical foundations of innovation

One of the major contributions of Schumpeter is related to the development of a dynamic analysis of innovation and technical progress, unlike the neo-classic literature, which privileges a static approach. He shows that it is possible to make significant progress in economics by integrating into it the analysis of technical phenomena. According to him, economic development is made up of the discontinuous introduction of new combinations of products and means of production. He thus identifies three activities in the process of innovation: the stage of invention which concerns scientific logic and discovery; the stage of innovation which is related to entrepreneurship, with the image of the innovating-entrepreneur who is able to exploit scientific discoveries. Once the innovation is put on the market, its diffusion in the productive system is carried out through the dynamics of competition. The entrepreneur being the one who introduces new combinations into the economy in a world characterized by uncertainty, he has the role to apply and develop innovations which may not be inventions. In this framework, science and invention are exogenous and are separate from innovation. Thus, the constitution of an invention and the development of the corresponding innovation are economically and sociologically two distinct things (Schumpeter, 1939, p 85).

Invention is born in an exclusively technical context. It is regarded as exogenous to the economic area considered. Perrin (2001, p. 17) defines it as «*a new technical principle, a new technical means using a given function*». Invention brings an answer making it possible to solve a problem thanks to the construction of a material (or immaterial) object. Based on scientific and technical knowledge available at a given moment, it introduces the idea of a rupture with the existing technical practices. Contrary to an invention, innovation is a broader concept which goes beyond the purely technical considerations to consider an economic, commercial or even financial concept. As Barlet et al., (1998) recall, it is the existence of a high market risk that potential innovators bear in their decisions of investing in the activities of research which differentiates innovation from invention. According to Schumpeter (1942), innovation is the source of the dynamics of change in the capitalist economy. The carrier of innovation is the entrepreneur who introduces into the economic process inventions provided by technical progress or exploits the potentials offered by new markets or new sources of raw materials. Schumpeter distinguishes five classes of innovations: the manufacturing of a new product, the introduction of a new method of production, the opening of a new outlet, the conquering of a new source of raw materials, and the realization of a new work organization. He thus associates with these different categories, the forms of rupture initiated by innovations. Although interesting, these classes of innovations have a wide dimension of analysis. This is why we prefer to use the usual classification of the types of innovation done by the Handbook of Oslo (2005) in order to clarify innovations in a company.

According to this handbook, an innovating firm is a firm which implements an innovation for a given period. Thus, an innovation is the implementation of a product (good or service) or of an appreciably improved new process, of a new

method of marketing or a new organizational method in the practices of a company, the organization of the place of work or external relations. The classification of these various types of innovation by categories preserves the maximum possible continuity with the definition of technological innovation of product and process appearing in the Handbook of Oslo (1997). Product and process innovations are closely related to the concepts of technological innovation of product – which is the development of a more powerful product with an aim of providing the consumer objectively new or improved services - and technological innovation of process – which is the adoption and implementation of new methods of production or distribution which are improved. Innovations in terms of marketing and organization widen the scope of innovations covered by the Handbook of Oslo (2005) which distinguishes four categories: product innovations, process innovations, marketing innovations and organizational innovations.

A product innovation corresponds to the introduction of a new or appreciably improved good or service on the level of its characteristics or the use for which it is intended. For each type of product, product innovation is supposed to increase the margin of profitability on the production sold to the current and future purchasers. It increases the selling price while adding or improving the technological functions built-in in a product (Guilhon, 1993). **A process innovation** is the implementation of a new or appreciably improved method of production or distribution of goods or provision of services. This concept implies significant changes in techniques, the hardware and/or software. The purpose of these types of innovation is generally to reduce the unit costs of production or distribution, to improve quality, or produce or distribute new or appreciably improved products. Process innovation lowers the average cost of production and increases the margin of profitability on the output sold (Guilhon, 1993). **A marketing innovation** is the implementation of a new method of marketing which includes significant changes in the design or conditioning, the arrangement, promotion or pricing of a product. These types of innovations aim at better satisfying the needs of consumers, opening new markets or to position in a new way a product of the firm on the market in order to increase sales. The implementation of a method of marketing which the firm did not use before shows a fundamental change compared to the methods of marketing already practised by the firm. This new method can be developed by the innovating firm or imported firm of another firm to be adopted. **An organisational innovation** is the implementation of a new organisational method in the practices, the organisation of the place of work or the external relations of the firm. Organisational innovation is related to the human/managerial aspects of the company. The purpose of this type of innovation is generally to improve the performance of a firm by reducing the administrative or transaction costs by improving the level of job satisfaction, by having access to non marketable goods or by reducing the costs of procurement. The distinction between these various categories is related to the intensity of the innovation. This intensity can be Radical (major) or incremental (minor)**.** Radical innovations refer to the design of truly new products. They allow a major change of

in the state of the art relative to competition to create new markets and/or modify consumption behaviour. They can have a radical or even revolutionary with a very high level of risk and uncertainty (sometimes total). On the other hand, incremental innovations (minor) refer to the improvement of the performance of existing products. They do not upset the usual terms and the state of the art of social supply, but make a noticeable improvement on these.

2. Literature review

Although the performance of an innovating firm can be measured in many ways, economic theory suggests that an above normal performance is necessary for an innovating company and depends on the characteristics of the company that affect the innovation process. The literature generally classifies them under the following headings.

2.1 Factors internal to the company

Among the traditional determinants identified in the abundant theoretical and empirical literature, the size of the company seems to be a significant indicator in some developing countries (El Elj, 2012; Rahmouni et al., 2010). This debate on the relationship between the size of the firm and its propensity to innovate has existed since Schumpeter (1942) who holds that large firms contribute to innovation more than small ones. In fact, due to the imperfection of capital markets, firms finance their innovation activity using their personal income or capital and these are higher in larger firms. These firms also have an easier access to financial resources to undertake expensive activities of R&D because of economies of scale and the more favourable position they occupy on the market. In addition, certain empirical studies show that the intensity of innovation is favoured by the small firms (Kamien and Schwartz, 1982). But these studies also unanimously agree that although expenditure in R&D increases logically with the size, the efficiency of this expenditure can decrease with it (Cohen 1995). However, SMEs in developing countries consume more new technologies than they do create, thus justifying why the majority of them have difficulties to emerge on export markets of manufactured goods with average and high technology contents and withstand competition. Karray and Ghorbel (2014) study the behavior of Tunisian companies, focusing on the effect of the main internal and external determinants of the capacity of innovation and show that the size of the firm has a significant impact depending on the type of innovation.

In the same manner, the competences and knowledge obtained through former experience and brought to the firm by the manager and employees appear at the forefront of the factors internal to the company. Companies need an adequate stock of highly and technically qualified labour to absorb new technologies, modify them, create and transfer new technological information. At the same time, creating a participative culture with a high employees involvement is an important way to

improve the companies' results, in such a climate the members of the organization feel more responsible for their actions and the degree of attachment to managers and organization is amplified (Nastase, Valimareanu, 2017).

Thus, empirical studies through different approaches show the crucial importance of managerial quality and the qualification of human resources in the reinforcement of the knowledge stock of the company which is a source of innovation and appropriation of technological and technical knowledge. According to Cohen and Levinthal (1990), the capacity of absorption of the company - to assimilate external knowledge and to create new knowledge - is determining for innovation, which is no more only related to the technological competences of the company but strongly depends on all factors which allow it to exploit the technological opportunities of its economic environment. This capacity of innovation of companies becomes more significant when it associates current technological results with its strategy to set up an economically intelligent activity. This technological results which relate to scientific, techniques (patents), technology (manufacturing process) and technico-economic information is a decision-making aid as regards the strategy of the company, of R&D policy, and patent rights policy (Jakobiak, 1991).

Moreover, R&D has become a factor of the strategic development of companies which want to become organisations «of international class». It is generally useful for the development of products and manufacturing processes, as well as for safeguarding and increasing competences in the treatment and use of external information. This activity of R&D is regarded as a main source of innovation, in the sense that it makes it possible for the company to produce new knowledge and to acquire specific knowledge and know-how and is decisive in acquiring new technologies and techniques to support the process of innovation. Freel (2000) in a study on the structure and the strategies of innovation of manufacturing companies shows that the presence of activities of R&D makes it possible to create a favourable climate that favours the flexibility of companies, their capacity to integrate new concepts and their adaptability to any modification of the market conditions.

2.2 Factors external to the company

The literature on the economics of innovation recognizes that the capacity to innovate of a company largely depends on external factors on which the company exercises no control.

Many authors show that customer relationship is an incubator of innovation. The orientation towards customers enables the company to develop its aptitude to satisfy the requirements of present and future customers throughout its life cycle while meeting the expectations of its shareholders. Siraudin and Domenech (2006) study the practices of companies largely recognized as innovating (Google, Oréal, etc) and find that innovating ideas come from the development of permanent and deep interactions with customers and a specific organization between the marketing of new products and R&D. The complexity

of this activity requires the interaction and exchange of the competences of all the internal and external partners of the organization. To do this, the company engages itself in a strategy of technological or inter-company co-operation in order to reduce R&D costs (Kriaa and Karray 2010), and improve the speed with which technology is transferred. This co-operation allows them to internalize their research on the one hand and to share the probable risks with their partners on the other, while benefitting from an external know-how. Thus, co-operation in research in which thousands of small firms interact in a very intensive way, making circulate knowledge through the labour market, direct and frequent exchanges, and through common infrastructures benefits the company. Frenken et al., (2012) show that small companies can compensate for internal low means by capturing external resources to innovate or position themselves on very dynamic trajectories of innovation like the technological start-up through co-operation.

Given the characteristics of high risk related to the activities of innovation on the one hand and imperfect information on the other, specific financial instruments have been developed and the aptitude of firms to handle them conditions their access to capital. For example, in the event of failure (if research does not yield fruits) of an innovation project, the initiators lose the entire funds invested, but in the event of success, what do they gain? Because of risk asymmetry (the initiator of the project has much to lose and little to gain) and information asymmetry related to the fact that the innovator usually has better information on the value of his project than the potential external investors, financial institutions are often reticent to finance the activities of innovation; thus causing an acute need for the financing of innovation. As the theory of contracts shows within a general framework, informational asymmetry causes moral hazard and anti selection. By admitting that banks, debentures or stock markets are not favorable to the financing of innovation, the financing of innovation can only be done internally by companies (self-financing) or by particular constitutions. In fact, innovating companies generally use their own capital to undertake projects. Empirical studies converge to show that the expenditure on research is largely auto-financed. In his study entitled «The financing of technological innovation» Martin (2008) shows that 30 % of innovating companies do not conclude their projects for lack of access to capital, that 73,8 % of the expenditure on R&D done by companies are self-financed and that approximately 20 % of the firms give up their projects because of a limited access to financial markets. Himmelberg and Petersen (1994) show that investment in research by innovating firms have a positive relationship with its past cash-flow (financial availabilities). This is frequently used as an argument to support the fact that small firms are handicapped compared to large ones in innovation, because of their low internal income. We can thus say that companies of developing countries that are mainly SMEs which do not have these resources face greater constraints. This is especially true since they are confronted with several obstacles: information asymmetry and the lack of financial intermediaries between investors and entrepreneurs. They also suffer from a lack of resources and loan collaterals and do not have past information to use to obtain them.

These studies show the importance of reconsidering the theoretical and empirical studies on the specificities of innovation and the nature of the relationship between productivity and innovation in developing countries. In these countries, the intensity of R&D is generally very low and the appropriation of technology through the acquisition or exploitation of patents, or with the help of the technological co-operation with research centers and laboratories is not always efficient. Also, it is shown that innovations in the developing countries are generally minor and incremental and are often not patented. The registration of inventions is not a common practice by innovating companies in these countries.

3. Methodology

The analysis of the process of innovation by companies considerably improved during the last decades thanks to the realisation and the exploitation of surveys known as Community Innovation Survey (CIS) carried out in many countries, not only developed, such as CIS surveys in the European Union, but also developing countries. In the absence of such a data source in French Sub-Saharan Africa, this study uses primary data collected during a uniform survey carried out in three countries (Cameroon, Senegal and the Ivory Coast) using the same methodological tools.

3.1 Data source

This study uses primary data on companies located in Cameroon, the Ivory Coast and Senegal. This data results from the survey «The Determinants of the Performance of Companies in French Sub-Saharan Africa: The case of Cameroon, the Ivory Coast and Senegal» jointly carried out in 2014 by the Economic and Monetary Research Laboratory (LAREM Senegal), the economic policy analysis unit of CIRES (CAPEC Ivory Coast) and the Research and Study Center in Economics and Management (CEREG Cameroon) in co-operation with the Research center for the International Development (CRDI). The method of quotas made it possible to determine the number of employees and firms to include in the sample in each company and country. The companies were selected going from the file of the companies available at the National Institute of Statistics (INS) of each of these countries. On the whole, all these companies (TPE, EP, ME and GE) are questioned on their activities between 2011 and 2013. The questions do not consider the information year by year but the firm data between these three periods. The questions asked are related to the company, the manager and the employees. At the end of the data collection, a sample of 1 897 companies of which 640 are in Cameroon, 723 in Senegal and 528 in the Ivory Coast are retained according to their capacity of innovation.

3.2 Statistical Analysis

Innovation being a qualitative change which leads modifications in an organisation (Schumpeter, 1939) and which constantly revolutionizes the economic entity from the interior, the process of its implementation accelerates the obsolescence of the existing sectors while generating the creation of new activities. The advances with the handbook of Oslo (2005) present a definition with four forms of innovation according to which a company which innovates is one «*that has achieved products or processes that are technically new or appreciably improved, or new methods of marketing or new organisational methods in the practices of the company, the organisation of the place of work or external relations»*. Concretely, the investigation considers that the innovation can be produced by the company and new to the market, or new for the company and not for the market and finally new for the company and the market. Thus, we identify innovating companies as those that innovate instantly or which do not carry out active R&D but which make use of their relational network (social capital) and the resources of their environment.

From the analysis of the data collected in the three target countries, we find that approximately 64,21% of the companies of the sample introduced at least one of the different forms of innovation (product, process, organizational and commercial), that is to say 72,61% for Cameroon, 56,15 % for Senegal and 65 % for the Ivory Coast (see table 1.3). This distribution of innovation in the broad sense is also observed at the level of the types of innovation. 77% of these companies introduced new or significantly improved products, that is to say 58,32% for Cameroon, 39,83% for Senegal and 36,45% for the Ivory Coast. The Cameroonian companies also seem to be prompter to innovate in the processes (52,25%), the organisation (54%) and at the commercial level (60,61%). The companies of the Ivory Coast appear as having the highest rate of commercial innovation with 46,92%, as against 29,46% for Senegal. The firms of these last two countries roughly have the same rates of organisational and process innovation, that is to say respectively 35% and 36,79% for Senegal and 37,57% and 48% for the Ivory Coast.

Table 1. Type of innovation per country (%)

Type of innovation	**Cameroon**	**Senegal**	**Ivory Coast**
Product innovation	58, 32	39, 83	36, 45
Process innovation	50, 25	36, 79	48, 97
Organisational innovation	53, 89	34, 99	37, 57
Commercial innovation	60, 61	29, 46	46, 92
Innovation in the broad sense	72, 61	56, 15	65, 05

3.3 Analysis of variables

According to the Schumpeterian definition of innovation as a new combination of the resources of the firm mobilizing its capacities and know how to produce a new or «quasi new» product. The determinants of the probability of innovating can be classified into four categories: the factors specific to the company (Y), factors related to ICT (TIC), factors related on the entrepreneur (Z) and the employees, and factors related to the economic environment (ENV).

With regard to the factors specific to the company, the effect of the size of the company is justified by the existence of sunk-in R&D fixed costs which supports large companies in the activity of research, particularly because of their greater financial ability (Cohen and Klepper, 1996). This indicator is measured by the number of employees and we expect a positive effect of this variable on the innovation behaviour. Following the legal basis of the National Institute of Statistics of Cameroon and organisations in charge of statistics in Senegal and the Ivory Coast, this indicator is classified in TPE, PE, ME and GE. While supposing, in line with Cohen and Klepper (1996) that the branch of industry represents the technological environment of innovation of the company, which allows the construction of a diversified knowledge base, empirical studies in developed countries have shown the importance of sectoral differences on the results of innovation. However, in the economies of developing countries such as French Sub-Saharan Africa, the branch of industry (SECT) plays a significant role with regard to the adaptation and flexibility which can enable firms to quickly capture technological opportunities or innovation present in this sector. Moreover, the economic analysis on the objective and subjective criteria of a firm leads to the adoption of a legal framework (legal form) and gives a legal status to the firm. This status which leads to an identity of the firm enables a legal protection and can have effects on the strategic behaviour of the company.

To these individual determinants, which were the subject of many empirical studies summarized by Cohen and Levin (1989), are added determinants related to the environment of the company. The dynamics of the various strands of the literature based on endogenous growth and the new theories of international trade is identified by Aghion et al. (2007) and Krugman (1979) who try to identify the effects of openness to foreign markets as well as the spillovers of knowledge on the incentive to innovate. Entrance into the export market helps the company to reinforce its competitiveness and improve its capacity of absorption while having access to new technologies and new products (Baldwin and Gu, 2004). Given these arguments, two indicators of competitive pressure are considered. The first (CONCUR_NAT) which is a binary variable, takes the value1if national competition affects the decision of innovation of the company and 0 if not. The second variable (CONCUR_INT) is also binary and takes into account the effect of foreign competition on the activity of innovation.

The other variables that are likely to influence innovation behavior are related to the market impulse or demand impulse (demand pull) and the advances in technology (techno-push). These indicators are the external characteristics of the

firm and can affect the behaviour of innovation significantly. Mairess and Mohnen, (2010) show that these factors make it possible for the innovating firm to widen its range of products and increase its market share. To capture these effects, the indicator «Demand pull» is a binary variable which is equal to 1 if the evolution of the needs of the consumers affects the decision of innovation and 0 if not. The indicator «Techno push» is also binary and is built using information on the acquisition of services of R&D and acquisition of technology and materials related to technological innovation. This information brings out the technological dynamics allowing the development of new activities of innovation. Engagement into an innovating activity in a developing country can thus be given according to demand conditions and technological activity of the company. Also, many others show that firms engage themselves in a relationship of co-operation to acquire new resources (Quélin, 1996). The engagement of the companies in a relation of co-operation can be encouraged by the combination and the complementarity of tacit competences, the creation of value by the facilitation of flexibility of the firm with respect to changes in its environment (Doz, 1992). To account for this aspect, we consider a binary variable (COOP) indicating the proportion of the companies which practice a partnership or a co-operation for the activities of innovation. Hajjem et al., (2015) show that the membership of a group and technological co-operation make it possible to the companies to acquire new sources of financing and share flows of knowledge with partners.

By admitting that the environment continuously poses new competitiveness challenges to companies, these companies must be able to satisfy in a very precise manner the needs of the customers, to anticipate and to adapt in a continuous manner to the new rules of its environment. They are thus obliged to respect national and international standards (for example: ISO 9 000 or 14 000, HACCP, AATCC)[2], which obviously has effects not only on the decision to innovate, but also on the success and returns of the activities of innovation. Lamia et al., (2014) show that the respect of the standards of quality gives the company a good image relative to its partners and contributes to an increase in the shares of the market. This study captures the effect of certification using a binary variable (CERT) which takes the value 1 if the firm innovating has a recognized international certification and 0 if not. The respect of standards does not always justify the success of a project of innovation because this last is characterized by a high risk and longer-term and random profitability. Thus, the rate of abandonment of innovation activities can impact on the decision of innovation. We capture this effect using a binary variable (ABAN) which takes the value 1 if the company gave up a project of innovation during the period of investigation and 0 if not. This problem of renouncing projects half way can be related to an unsafe business environment. The optimization of the production of the public good related to a safe and secure business environment of can make it possible for innovating firms to benefit from

[2] A norm is a document which defines requirements, specifications, directives or characteristics to use systematically to ensure the operating requirement of materials, products, process and services. ISO 9000 or 14 000: Standards related to the system of quality and environmental management, HACCP: Norms for the quality of food, AATCC: Norms for the quality of textile products.

legal protection. In this study, the appreciation of the business environment is a binary variable (ENV) which takes the value 1 if the company finds the safety of environment satisfactory and 0 if not.

Concerning the variables related to the manager, certain characteristics can be used to measure the managerial capacity of the head of company, i.e. his capacity in the management of innovation. Taking as basis the theory of human capital which considers that knowledge increases the capacity of the individual and contributes to the management of activities (Becker, 1964), certain authors establish a relationship between education, management and the success of the economic activity or the creation of value (Davidsson, 2002). Allemand and Schatt (2010) analyze the impact of training and experience which determines at the same time the incentives of the manager and his constraints as regards decision-making. Given the nature of the survey data, we use the level of education (NIVEAU) of the head of the company to evaluate the effect of human capital on the behaviour of innovation. This study thus considers a variable with three classes, equal to 1 if the manager has the primary education level, 2 if he has the secondary level and to 3 if he has the level of higher education. The variable gender (SEX) is a binary variable equal to 1 if the head of company is male and 0 if not. In the same manner, the variable experience (EXPER) is binary and is equal to 1 if the manager had an experience before reaching the position of manager and 0 if not. In addition to these variables related to the characteristics of the manager, we build a composite indicator of the capacity of the manager to manage activities of innovation. This capacity is considered as the capacity of financial management, human resource management and management of the socio-economic environment of the company.

The other variables likely to affect the decision of innovation are related to the use of certain information and communication technologies (Intranet, Internet) for the search of business opportunities, production management, and the quality of human resources. The choice of this variable is based on the idea that the adoption of ICT allows companies to increase their output, to improve their productivity, widen the range of their new products and services and innovate. The effect of ICT is thus captured by three indicators: use of the Internet for business operations through the Internet (ENTERNET), use of machines and specialised software in the production process (TIC_PRO) and the use of ICT for publicity and marketing of products (see appendix: table A1).

4. Econometric Analysis of the determinants of the behaviour of innovation

To identify the determinants of the behaviour of innovation in this study, we use a Tobit type II model after a literature review. The advantage of this model is that it particularly makes it possible to reveal the more or less strong correlation existing between the decision to innovate of firms and the decision on the amount of investment in the activities of innovation.

4.1 Specification of the model

The Tobit model is a model with limited dependent variable, i.e. a model for which the dependent variable is continuous but is observable only on a certain interval. It is thus a model which is midway between the linear regression model where the dependent variable is observable and qualitative models. However, this censored regression model[3] first developed to model the relationship between the income of a household and expenditure in durable goods, is generally used to explain the relationship between the decision of innovation and investment in the activities of innovation. Thus, it is considered that a firm decides simultaneously whether it will innovate or not and on the amount of investment which it will assign to its activity of innovation.

Supposing a sequential behaviour of the company, it initially decides whether to innovate or not. This decision can be represented by the following dichotomous model:

$$\mathbf{Innov}_i = \begin{cases} 1 \text{ si si } \mathbf{Innov}_i^* > 0 \\ 0 \text{ sinon} \end{cases} \quad \text{with } \mathbf{Innov}_i^* = X_1'\beta_1 + \varepsilon_{1i} \qquad (1)$$

Secondly, if it decides to innovate, it decides the amount of investment (**Invest**) which it will devote to the activity of innovation.

$$\mathbf{Invest}_{innov_i} = X_2'\beta_2 + \varepsilon_{2i} \quad \text{if} \quad \mathbf{Innov}_i = 1 \qquad (2)$$

Where: $\mathbf{Innov}_i$ is a binary variable equal to 1 if the company carries out at least an activity of innovation; $\mathbf{Invest}_{innov_i}$: amount of investment in the activity of innovation; $\mathbf{Innov}_i^*$:a latent variable;[4] X_j : a vector of the explanatory variables with; $\varepsilon_{1,i}$ $j = 1, 2$ and: $\varepsilon_{2,i}$ The error term which follows a normal distribution such that $\varepsilon \to N\left(0, \sigma_j{}^2\right)$ with $E\left(\varepsilon_{1,i}, \varepsilon_{2,i}\right) = \rho$ and ρ the coefficient of correlation between the disturbances of the two equations.

Thus, only the sign of the variable $\mathbf{Innov}_i^*$ is observable and the variable $\mathbf{Invest}_{innov_i}$ is observable only when $\mathbf{Innov}_i^* > 0$. It is supposed that the variables X_1 are observable for all the companies of the sample, while it is not necessary

[3] A regression model is known as censored when one has less observations of the explanatory variables on the whole of the sample (Jacquot, 2000). Whereas it known as truncated when all the observations of the explanatory and dependent variable in a certain interval are completely lost.

[4] The latent variable is a non-observable and representative of the studied phenomenon.

that the variable X_2 be observable for the companies for which $\mathbf{Innov}_i^* \leq 0$. After this, we suppose that these characteristics are observable for all the individuals.

Generally, the parameters of the Tobit model are estimated by maximum likelihood (MV). However, we consider it useful to resort to other simple methods of estimation which make it possible to have a first idea of the size of the parameters and which can moreover serve in the phases of determination of initial conditions in the optimisation of probability. Thus, we adopt the method of estimation of Heckman (1976) in two steps which consists in initially estimating the equation of innovation (equation of selection) using a dichotomous Probit, then building the ratio of Mills going from the estimates of the first equation (innovation) and introduce it into the linear regression of the amount of investment in the activity of innovation. The amount of investment depends on the decision to be involved or not in an activity of innovation; i.e. this amount is observed only for companies having realised at least an activity of innovation. So there is a risk of selection bias, which is why we use this model, a model which makes it possible to address this problem by introducing a selection equation.

In the first stage, we estimate a dichotomous probit model. The decision to innovate being a qualitative variable, the probability that company ***I*** innovates (***Innov*** $_I$ **= *1***) is then

$$prob(\mathbf{Innov}_i = 1) = prob(\mathbf{Innov}_i^* > 0) = \Phi(X_1'\beta_1) \qquad (3)$$

Going from the estimator θ_1 obtained by estimating the probit model, we build the Ratio of MillS $\lambda(X_1'\theta_1)$ for each observation $X_{1,i}$. To build the ratio of Mills, we first of all seek to build the conditional mean of the sequential behaviour of the company. $E(Invest_{innov_i} / Innov_i^* > 0)$. By expressing the function of investment in the activities of innovation in terms of a linear projection of the residuals $\varepsilon_{1,i}$ on $\varepsilon_{2,i}$, we have:

$$E(Invest_{innov_i} / Innov_i^* > 0) = X_2'\beta_2 + \rho\sigma_1^{-1}\lambda(X_1'\theta_1) + \mu_{2,i} \qquad (4)$$

With $\mu_{2,i} = \varepsilon_{2,i} - (\rho\sigma_1^{-2})\varepsilon_{1,i}$ Thus, we obtain a model written by the following linear relationship:

$$Invest_{innov_i} = X_2'\beta_2 + \sigma\lambda(X_1'\theta_1) + \upsilon_i \qquad (5)$$

With; $\upsilon_i = \varepsilon_{2,i} - (\rho\sigma_1^{-2})\varepsilon_{1,i} + \left[Invest_{innov_i} - E(Invest_{innov_i} / Innov_i^* > 0) \right]$

$E(\upsilon_i) = 0$; and $\sigma = \rho\sigma_1^{-1}$ an asymptotically convergent estimator of the ratio of parameters $\rho\sigma_1^{-1}$. By assuming in line with Heckman (1976) that υ_i is independently distributed relative to $Innov_i^*$. We then estimate this equation (5) by the method of ordinary least squares (MCO). The application of this method in STATA13 yields the following results.

4.2 Econometric results

Table 2: Estimates of the Tobit II model

Variables	Estimation of innovation								Marginal effects			
	Cameroon		Senegal		Ivory Coast		Global		Cameroon	Senegal	Ivory Coast	Global
	Probit	Tobit	Probit	Tobit	Probit	Tobit	Probit	Tobit				
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	dy/dx	dy/dx	dy/dx	dy/dx
TPE	.156 (.436)	-.549 (.778)	-.202 (.600)	-1.45 (1.50)	.848*** (.278)	4.68*** (1.40)	.390** (.153)	1.08* (.631)	.035 (.102)	.0733 (.209)	.28*** (.086)	.121*** (.044)
PE	.0945 (.457)	-.841 (.763)	-.371 (.600)	-2.23 (1.85)	.882*** (.320)	1.47 (1.64)	.449** (.197)	-.499 (.800)	.0204 (.094)	.145 (.265)	.34*** (.120)	.162** (.075)
ME	.259 (.394)	1.85*** (.597)	.8531 (.836)	5.395* (3.06)	.578** (.279)	1.092 (1.13)	.199 (.213)	.0988 (.757)	.0519 (.069)	.250 (.166)	.222** (.110)	-.069 (.077)
Secondary sector	.481 (.907)	2.23* (1.23)	.7428 (.556)	.9800 (2.15)	.0272 (.655)	1.274 (3.05)	.4821 (.315)	1.814 (1.30)	.0968 (.162)	.257 (.173)	.0096 (.232)	.1474* (.088)
Tertiary sector	.5320 (.901)	2.109* (1.20)	.3850 (.546)	.629 (2.06)	.1690 (.652)	1.698 (3.06)	.4226 (.313)	1.234 (1.27)	.1340 (.250)	.1469 (.209)	.0612 (.239)	.1453 (.111)
SARL	.3140 (.364)	-1.18 (.776)	.1115 (.327)	-.818 (1.40)	.7295* (.398)	1.385 (1.61)	.662*** (.104)	-3.14*** (.6193)	.0630 (.064)	.0413 (.119)	.272* (.150)	.200*** (.028)
SA	.6692 (.450)	-.953 (.823)	.1499 (.412)	.0701 (1.65)	.981** (.418)	.2969 (1.69)	.796*** (.154)	-3.07*** (.721)	.1134 (.054)	.055 (.147)	.277** (.086)	.2072*** (.030)
EI	.4147 (.240)	-2.04** (.848)	-.432 (.334)	-1.07 (1.71)	.7134 (.490)	-.905 (1.96)	.1258 (.127)	-3.50*** (.782)	.0990* (.060)	-.168 (.132)	.206 (.106)	.0406 (.040)
Demad pull	1.22*** (.204)	2.38*** (.781)	…	…	.0115 (.254)	3.700*** (1.29)	.607*** (.141)	-.276 (.707)	.335*** (.063)	…	.0041 (.090)	.1790*** (.036)
Techno push	.1716 (.275)	.0611 (.395)	.997*** (.196)	2.74*** (.907)	.0799 (.312)	8.077*** (1.07)	.617*** (.138)	3.34*** (.707)	.0363 (.054)	.322*** (.049)	.0280 (.107)	.1740*** (.032)
CONCUR_NAT	.2302 (.210)	-2.83*** (.733)	-.0938 (.143)	.4779 (.908)	.2319* (.137)	.2536 (.663)	.210** (.082)	.1620 (.478)	.0530 (.049)	-.035 (.053)	.083* (.049)	.0703** (.028
CONCUR_INT	-.198 (.193)	-.880** (.411)	.263** ((.132)	.2152 (.738)	.0285 (.181)	-1.34* (.744)	.0739 (.088)	-.240 (.429)	-.046 (045)	.0977** (.053)	.0101 (.064)	.0241 (.028)
NORD	-.293 (.392)	.9728* (.564)	.3221 (.306)	-1.01 (1.63)	-.736* (.390)	-2.36 (1.78)	.2189 (.140)	1.467** (.631)	-.075 (.112)	.1185 (.109)	-.2766* (.148)	.0692* (.042)
ENV	-.155 (.177)	.1992 (.551)	…	…	.6354*** (.162)	-.535 (.772)	.2393** (.104)	-.067 (.619)	-.033 (.036)	…	.240*** (.062)	.0827** (.037)
ABAN	1.02*** (.16767)	.1795 (.424)	.860*** (.143)	.6859 (.735)	…	…	.931*** (.104)	1.284** (.514)	.215*** (.035)	.298*** (.044)	…	.260*** (.024)
COOP	.3217* (.193)	-.005 (.430)	.672*** (.230)	-2.47*** (.964)	.5795** (.260)	-.572 (1.13)	.360*** (.121)	-1.50*** (.535	.069* (.039)	.225*** (.065)	.177** (.065)	.110*** (.034)

Variables	Estimation of innovation								Marginal effects			
	Cameroon		Senegal		Ivory Coast		Global		Cameroon	Senegal	Ivory Coast	Global
	Probit Coef.	Tobit Coef.	Probit Coef.	Tobit Coef.	Probit Coef.	Tobit Coef.	Probit Coef.	Tobit Coef.	dy/dx	dy/dx	dy/dx	dy/dx
INFO_GPE	.735*** (.1524)	.4590 (.4945)	.5140** (.2330)	-1.37 (1.3201)	…	…	.497*** (.1191)	-.925 (.6319)	.178*** (.038)	.183** (.0776)	…	.153*** (.033)
INFO_MARCH	.56791*** (.1968)	.6886* (.4123)	…	11.301** (5.1267)	…	…	.42658** (.1956)	.71773 (.7739)	.113*** (.034)	…	…	.1243** (.048)
FOND_PRO	…	-1.533 (1.6536)	-.0807 (.2433)	-2.7821 (1.7433)	1.0998* (.5892)	-4.005 (3.131)	.0528 (.19717)	-2.56** (1.296)	….	-.0299 (.0889)	.4171* (.1964)	.0176 (.067)
EMPRUNT	…	…	-.00174 (.1562)	-1.560** (.7610)	…	-3.795 (5.711)	-.0227 (.1357)	-1.1454* (.6934)	…	-.0006 (.058)	…	-.0075 (.045)
INTERNET	-.1768 (.29858)	-.3115 (.4875)	.12379 (.2007)	1.0064 (.9158)	.25915 (.2681)	-.2908 (.9372)	-.0831 (.1416)	.27231 (.5252)	-.042 (.073)	.0458 (.073)	.087 (.085)	-.027 (.048)
TIC_MARK	-.0027 (.3051)	2.0219*** (.5286)	.20912 (.1998)	1.0379 (.9000)	.4662* (.2753)	.4702 (1.0187)	.11698 (.1333)	2.476*** (.5431)	-.0006 (.069)	.0771 (.072)	.151* (.079)	.0378 (.042)
TIC_PRO	.5761* (.3530)	-.1305 (.51256)	-.3325 (.2338)	2.1955* (1.1469)	.2170 (.2692)	-.0810 (1.078)	-.2161 (.14718)	.65883 (.5868)	.1163* (.063)	-.127 (.090)	.0747 (.089)	-.073 (.051)
SEXE	.14707 (.1629)	-.0261 (.521)	-.4110** (.1849)	-1.6281 (1.187)	.0006 (.14757)	1.1548 (.7368)	-.0022 (.0913)	.5777 (.51603)	.0342 (.039)	-.143** (.058)	.0002 (.052	-.0007 (.030)
EXPER	-.0853 (.15878)	.2367 (.4140)	.0077 (.1343)	-2.0688** (.9250)	.08825 (.1313)	.71194 (.6338)	-.0188 (.0754)	.0329 (.43285)	-.019 (.035)	.0029 (.050)	.0315 (.047)	-.0062 (.025)
SECOND	-.1651 (.18523	-.0688 (.5895)	.0845 (.1644)	.52167 (1.009)	.03349 (.1708)	1.484* (.7960)	-.04697 (.0902)	1.068** (.5331)	-.037 (.042)	.0314 (.060)	.0119 (.060)	-.0156 (.030)
SUP	.10277 (.2197)	-.9803 (.6695)	.13738 (.2282)	.11448 (1.0726)	-.0711 (.2274)	3.514*** (.9899)	-.1008 (.1225)	.95107 (.6023)	.0227 (.049)	.0509 (.083)	-.025 (.082)	-.033 (.041)
GESTION_RH	.0961 (.38299)	1.935 (1.2358)	.01217 (.2461)	-.2059 (1.7854)	.4684* (.2633)	.4150 (1.3065)	.1007 (.1527)	.42153 (.92899)	.0217 (.086)	.0045 (.092)	.1668* (.093)	.0332 (.050)
GESTION _FI	.11315 (.2325)	.6702 (.6605)	.8423** (.3362)	-4.5434** (1.851)	.1385 (.2362)	-2.009* (1.071)	.2771* (.1458)	-2.44*** (.707)	.0255 (.052)	.3161** (.126)	.0493 (.084)	.0913* (.048)
GESTION_ENV	.62317* (.3288)	-.4831 (.8888)	1.1266*** (.2860)	.5196 (1.5514)	1.047*** (.2452)	-3.17** (1.285)	1.046*** (.1490)	-.987 (.818)	.1406* (.073)	.422*** (.107)	.373*** (.088)	.344*** (.048)
Constant	-2.4897** (1.0165)	8.795*** (3.289)	-1.1890 (.89705)	14.120*** (1.5514)	-2.4776*** (.4790)	12.24** (5.555)	-1.658*** (.3449)	9.74*** (2.5642)				
Innov_Lage	.6958*** (.1422835)		1.1704*** (.1166)		.3516*** (.1145)		.6840*** (.0669)		Probabilités prédites			
Mills Ratio	-2.499* (1.3962)		-.08385 (1.2098)		-5.659* (3.419)		-1.816* (1.010)					

	Estimation of innovation								Marginal effects			
Variables	Cameroon		Senegal		Ivory Coast		Global		Cameroon	Senegal	Ivory Coast	Global
	Probit	Tobit	Probit	Tobit	Probit	Tobit	Probit	Tobit				
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	dy/dx	dy/dx	dy/dx	dy/dx
rho	-0.8225		-0.018		-0.8971		-0.377					
σ .	3.0389		4.4794936		6.3077912		4.8132					
N(censored/total)	489/639		517/723		272/523		1 278/1897					
Wald Test	106.98***		68,81***		263.33***		365.76***		.8570	.6364	.6828	.7320

Note: ***; **; * respectively significant at 1%; 5%; and 10%, Standard deviations in brackets, RH: Human Resources; ENV: Environment; Fi: financial

Since only the signs of these coefficients have an informational content, the marginal effects[5] of the various explanatory variables on the various types of innovation are discussed. Table 2 presents the marginal effects evaluated at the mean of all the explanatory variables, as well as the standard deviations[6] on the uni-variate probabilities of innovations in each country.

5. Discussion

The results confirm the Schumpeterian hypothesis since the effects of the variable size of the company are partially significant and positive depending on the country on the decision to innovate and to invest in innovating activities. In fact, a unit increase in the size of small companies in the Ivory Coast increases the propensity to innovate from 28 to 34% respectively for very small and small companies. This indicator is non-significant for the companies of Cameroon and Senegal, but positive and significant on the propensity to invest in activities of innovation in these two countries. This result is in conformity with the results of the empirical studies undertaken by Kremp and Tessier (2006) in France who find a positive correlation between the size of companies and investment in activities of R&D.

Factors related to the economic environment of the firm

Market impulse and the technological dynamics have positive and significant effects on the behavior of innovation in French Sub-Saharan Africa. The launching of these innovating activities depends on the impulse by demand because the company would be encouraged to engage in various activities of innovation not only in order to achieve its goals, but also to widen its line of goods, to conquer new markets and to fulfill the requirements of demand. In fact, the enthusiasm of Cameroonian firms in the activities of innovation increases (marginal effect of 33%) when they seek to satisfy the market requirements in terms of quality, price and conditioning. But despite this significant effect in Cameroon, we notice that the impulse by demand exerts a positive and non-significant effect on the innovation behaviour of the companies of the Ivory Coast, but significant on the amount of investment in innovation activities. It could be that the firms of the Ivory Coast invest much more in the activities of innovation to widen their range of products in order to increase their share of the market. As for technological impulse, it has a

[5] According to Richard (2016) the marginal effects, also called instantaneous rates of change, are calculated for a variable while all the other variables are maintained constant. The size of the marginal effect depends on the values of the other variables and their coefficients. The independent variable being binary, the marginal effects measure the discrete variation, namely how the predicted probabilities change as the binary independent variable changes from 0 to 1

[6] The standard deviation is used to measure the dispersion or spread of a set of values around their average. The less the value of the standard deviation, the more homogenous the population observed is.

positive and significant effect on the behaviour of innovation of firms. This shows that the stronger the technological push is, the more the firms are motivated to engage in innovation activities since technological advancement is one of the vital components of the process of innovation. Taken individually at the level of the countries, this indicator is non-significant for Cameroon. An explanation of this would be, in line with Nkouka et al., (2013) that the transfers of technology from which these Cameroonian companies benefit rather creates in them a dependence on the technical progress made by their partners.

The co-operation between firms or membership to a group of companies positively and significantly affects the behaviour of innovation of firms in Fench Sub-Saharan Africa. This high significance is explained by the fact that co-operation facilitates economic action and makes it possible for companies to widen their sphere of activity, to save their means and gain access to exclusive resources and opportunities. In fact, in a context characterised by a majority of SMEs, membership allows access to other financial resources and knowledge, or other synergies making it possible to invest in more innovating activities and to begin in other external activities of innovation involving the other companies of the group. These results are in line with those of Hajjem et al., (2015) showing that membership supports the automation and acquisition of new technologies and facilitates communication between the various subsidiary companies. Concerning the sources of information for the activities of innovation, information coming from the market and membership groups of the firm influences the behaviour of innovation significantly. In Cameroon and Senegal, companies who base themselves on information from their groups to innovate spend more on their activity (significantly positive marginal effect with an average of 18% for Cameroon and Senegal and 15% globally). On the other hand, when they base themselves on needs and consumer's choice as source of information, they invest less in their activities (significant positive marginal effect of 11% for Cameroon and 12% globally). This difference is explained by the fact that generally, information coming from the market directs companies towards the activities of non-technological innovation which are generally less expensive than those of technological innovation.

Factors related to ICT

While interesting ourselves in the relationship between ICT and innovation, we can read from table 2 that the fact of using ICT tools for in the production process increases the propensity to innovate of Cameroonian firms (significant marginal effect of 11,6%). The use of these tools for publicity and marketing has a negative and non-significant effect on the behaviour of innovation of Cameroonian companies and is significant and positive for those of the Ivory Coast. A plausible explanation is that the sector of «e-commerce» is quasi non-existent in Cameroon, unlike the Ivory Coast. But these factors of equipment and use of ICT also have different effects on the propensity to invest in the activity of

innovation. This difference in the results is proof that various equipment and uses have different effects on the activity of innovation, or on each type of innovation.

Factors related to the capacity to manage the process of innovation

If since Cantillon and Jean-baptiste Say, the founders of the field of entrepreneurship, it is admitted that innovation and entrepreneurship are related concepts, it is partly because the decision to invest by the agents motivated by profit necessarily implies that these agents are able to perceive unexploited economic or technical opportunities (Dosi, 1988). That supposes that this agent must have a set of skills (managerial, entrepreneurial and industrial) generally conferred by his managerial capacity. These ideas are confirmed by results obtained on the global set of companies where we find the abilities in financial management and management of the social environment have significant effects on the decision of innovation and the propensity of investment in the activities of innovation. This is explained by the fact that the choice of the mode of integration aiming at preserving the specificities of the entities and at maintaining a balance of power stimulates the decision of innovation. A management based on the ethics of competence pushes individuals to be more innovating and become «champions» of the change; i.e., once a new idea is developed, the individual makes an enthusiastic promotion, seeks support, fights the forms of resistance to it and makes sure that the innovation is born.

Conclusion

The objective of this study is to carry out a comparative analysis of the determinants of innovation between three countries of French Sub-Saharan Africa. Drawing inspiration from the study by Sakala and Koster (2014) and Nkouka et al. (2013), we perform an extension to a generalised type II Tobit model in the African context, which consists in introducing investments in activity of innovation as an input of innovation and considering technological and non-technological innovations as output of innovation. The estimation devoted to the input innovation regards investment in the activity of innovation as dependent variable. This function of investment in the activity of innovation, estimated by the Tobit model is made up of two equations. The first (equation of selection) is estimated by a probit model and the second (equation of the amount of innovation) by the Heckman (1976) method that makes it possible to correct the problem of selection bias.

The econometric results show that the three countries have the same determinants of the behaviour of innovation with only a few differences. As a whole, the decision of the amount of investment in innovating activities depends on the decision to engage or not in an innovating activity. This activity of innovation is a function of the market impulse, the technological impulse, the co-operation between firms, the managerial ability of the head of company, the rate of

abandonment of the activities of innovation in the past and the possibilities of obtaining a standard or international certification. They also show that the decision to innovate is determined by technological co-operation between firms or technological cooperation, the market impulse, national and international competition, technological impulse, the sources of information, the safety of the environment of intellectual property and the rate of abandonment of innovation projects in the past. However, Cameroonian companies unlike the others base themselves much more on information coming from the market and their group of membership (between firms, professional…) to engage in innovating activities, while those of Senegal engage more in the innovating activities if they are under international competition pressure. As for companies of the Ivory Coast who were touched by the post electoral crisis of 2011, they rely on their private funds to finance the activity of innovation, and generally engage in these innovation activities following the level of safety of the business environment and social protection of intellectual property.

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Appendix:

Table A1: description of variables

Variables	Description de variables
Caractéristique de la firme	
Size	Qualitative variable with values 1 = TPE, 2 = PE, 3 = ME et 4 = GE
Legal Structure	1 = SARL, SA = 2, EI = 3 , Autres = 4
SECT	Sector of acticivity: Qualitative variable with values : 1 = primary, 2 = secondary, 3 = tertiary
Variables liées à l'environnement de la firme	
Demand pull	Impulsion by demand: Binary variable with value 1 if the company ii=nnovates following the needs of consumers and 0 if not
Techno push	Technological push : binary variable 1= yes and 0 no
Coop	Cooperation : Binary variable with value 1 if the company practices an inter-enterprise partnership or cooperation in matters of innovation and 0 if not
CONCUR_NAT	National competition : Binary variable with value 1 if national competition affects the innovation decision and 0 if not.
CONCUR_INT	International competition: Binary variable equal to 1 if international competition affects the decision to innovate and 0 if not.
NORD	certification: Binary variable that takes the value 1 if the company has a recognised international certification.
ABAN	Abandonment of innovation activities: Binary variable that takes the value 1 if the company abandoned an activity of innovation and 0 if not.
ENV	Appreciation of the business environment: Binary variable that takes the value 1 if the company finds the business environment secure and 0 if not.
Source of financing	Categorical variable that takes the value 1 for private funds (FOND_PRO) , 2 for loans and 3 for others
Source of information	This is a categorical variable that takes the value 1 if the information comes from the market (INFO8MARCH) ; 2 if it is from the membership group and 3 for other sources
Factors related to ICT	
INTERNET	Internet: Binary variable equal to 1 if the company carries out business operations through the internet.
TIC_PRO	ICT in the production process: Binary variable with value 1 if the company uses machines and specialised software in its production process and 0 if not.
TIC_MARK	ICT for advertising and marketing of products. This is a binary

	variable that takes the value 1=yes and 0=no
Factors related to the characteristics of the manager	
SEX	Gender : Binary variable 1 = male, 2 = female
EXPER	Experience: Binary variable with value 1 if the manager had former experience before becoming manager and 0 if not.
NIVEAU	Level of education: Variable with three classes equal to 1 if the manager has a primary level, 2 if he has a secondary level and 3 if he has a higher level of education.
Managerial capacity	Based on the characteristics of the entrepreneur, we build an index of human resources management, financial management and the management of the social environment of the company.