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A Synthetic Indicator of the Quality of Support for Businesses in Burkina-Faso, Cameroon, and Ghana

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Abstract

This paper proposes a synthetic indicator of the quality of support for companies and identifies the factors that can contribute towards improving the quality of such support in three countries (i.e., Burkina-Faso, Cameroon, and Ghana). The study uses static mechanics and applies techniques of factor analysis. A principal component analysis is performed on the data collected from 80 business support structures in the sampled countries. After constructing the indicators, correlates are provided on how the constructed indicators are linked to the objectives of sustainable development. Our results are robust after controlling for variables relating to the general characteristics of the support structure. The findings are consistent with the position that taking sustainable development objectives into account in business support practices would significantly improve business performance in sampled countries and, by extension, in sub-Saharan Africa. The originality of the study stems from the fact that it considers specific sustainable development goals and assesses their contribution to improving the quality of support for companies, a research area that has not been investigated hitherto by the extant literature. Implications for all stakeholders in the entrepreneurial ecosystem and future research directions are discussed.

Keywords Synthetic indicator · Quality of support · Businesses · Sub-Saharan Africa

JEL Classification C30 · M20 · O10 · O30 · O55

Introduction

The premise of proposing a synthetic indicator of the quality of support for businesses in sub-Saharan Africa is twofold: (i) the relevance of business incubators and social enterprises in promoting inclusive and sustained economic and human

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developments in Africa and (ii) the essence of complementing the extant literature by addressing apparent gaps in the sparse scholarship focusing on the sub-region. These highlighted motivational elements are discussed to elaborate detail in two strands, following the same chronology.

irst, contemporary development priorities in SSA (sub-Saharan Africa) are guided by sustainable development goals related to the promotion of sustained and inclusive economic growth because of at least two main fundamentals in scholarly and policy circles: (i) majority of countries in the sub-region failed to achieve most millennium development goals targets, especially those related to extreme poverty and inequality (Asongu et al., 2020; Tchamyou et al., 2019) and (ii) according to projections, without robust, inclusive growth strategies in the sub-region, most countries in SSA are unlikely to meet the target of limiting extreme poverty to a threshold of less than 3% by 2030 (Bicaba et al., 2017).

Business incubators and/or start-up accelerators are worthwhile in strengthening the private sector for employment and growth opportunities relevant to the achievement of most poverty, growth, and inequality-oriented SDGs (Haugh, 2020; De Bernardi & Azucar, 2020; Agarwal, 2020; Millette et al., 2020; Kouam & Asongu, 2022). Hence, providing a measurement with which to assess the quality of support for businesses in SSA is worthwhile, not least, because beyond the highlighted practical and policy relevance, such a study also bridges an apparent gap in the extant scholarship that has largely focused on nexuses among capital providers, business incubation, impact investment, and sustainable development outcomes.

Second, from a broad perspective, the extant contemporary literature has focused on many dimensions of SDGs (sustainable development goals) notably the following: Haugh (2020) has examined the importance of enterprise development and business incubation in the alleviation of poverty (or SDG1) in developing countries; De Bernardi and Azucar (2020) focus on responsible research and innovation for food security (or SDG2); Spitzer-Shohat et al. (2020) are concerned with the development of a new social incubator for the promotion of health initiatives (or SDG 3); Agarwal (2020) is concerned with inclusive rural growth by means of socio-economic-ecological interfaces (or SDGs 6, and 10); and Millette et al. (2020) analyze the importance of business incubation in cleaner energy use (or SDGs 7 and 13).

Studies closest to this proposal in the literature are Nair and Blomquist (2019) and Surana et al., (2020) because the extant African-centric business incubation literature has largely focused on other areas. We first discuss how the positioning of this proposal departs from the underlying closest stream of studies before clarifying how the proposal also steers clear of the corresponding African-centric literature on the subject.

Nair and Blomquist (2019) have built on experiences from business incubation management and failure prevention to provide insights into practices that can be used to scale-up and sustain incubation-driven business models. The findings are based on case studies from nine Swedish business incubators. Surana et al. (2020) focus on how science, technology, and innovation-based incubators can be leveraged to achieve SDGs within the context of India.

The present study is similar to the two studies because, on the one hand, it is consistent with Nair and Blomquist (2019) in its aim to provide practical insights

into the success of incubation-to-scale or generalizability of best practices from one country to another across SSA. Accordingly, by providing a synthetic measurement for business support and corresponding determinants of quality of support for business indicators in SSA, the study provides critical policy and practical factors that are important in either improving or decreasing the quality of business support. For instance, more actions and resources can be placed on favorable determinants and vice versa for unfavorable determinants.

In light of the above, by focusing on more countries within the context of developing countries and engaging substantially more case studies, this study obviously departs from Nair and Blomquist (2019) in terms of how practical insights from the corresponding case studies can be representative and by extension, relevant to other countries with comparable development contexts.

Moreover, this argument on the importance of sample size for plausible generalizability is also a distinct feature of this study relative to Surana et al. (2020). Accordingly, Surana et al. (2020) have focused on fifteen case studies. In essence, by assessing 80 case studies from three countries (Cameroon, Ghana, and Burkina Faso), this study complements the underlying literature within the context of SSA. Furthermore, the study also provides more robust cross-country practical insights on determinants of the quality of business support that can be used to prevent failure and enhanced business incubation management. Hence, there are obviously practical (i.e., in terms of business incubation management), scholarly (i.e., positioning in accordance with a gap in the extant contemporary literature), and policy (i.e., importance of business in driving sustained and inclusive growth) motivations of the study.

The above contribution to the extant literature departs from the contemporary African-centric business incubation literature that has for the most part been concerned with, *inter alia*: insights into disparities between privately owned incubators and those that are operated by the state in South Africa (Masutha & Rogerson, 2015); nexuses between unemployment, incubation hubs, and the youth prospects in Southwest Nigeria (Akanle & Omotayo, 2020); the role of government in moderating barriers to technology-driven business incubators in Nigeria (Obaji & Olaolu, 2020); insights into possibilities, opportunities, and threats surrounding Africa's transformation by means of automating knowledge work; case studies on emerging enterprises that place emphasis on the integration of economies, ecology and society for sustainable systems of food production; and the linkages between open development activities and scaling-up of clustered enterprises in the informal economic sector (Jegede, 2020).

According to Graça and Camarinha-Matos (2017), the extant literature on business incubators has largely focused on, *inter alia*: models of collaborative networks (Abreu & Camarinha-Matos, 2008; Camarinha-Matos & Macedo, 2010; Piot et al., 2007), supply chain performance metrics framework of seminal works (Gunasekaran et al., 2001, 2004; Lorentz et al., 2011) with Ramanathan (2014) providing a comprehensive summary, indicators for relationship analysis (Abreu & Camarinha-Matos, 2011), indicators for asset analysis (Abreu & Camarinha-Matos, 2011), social network analysis indicators (Allee et al., 2015), and value network analysis indicators (Allee et al., 2015). Unfortunately, the extant literature which is prior to the advent of SDGs has been skewed towards developed countries and profit-oriented business performance

indicators. As argued above, the present study departs from the extant literature by focusing on African countries with particular emphasis on SDGs.

The rest of the study is organized as follows. The theoretical underpinnings are discussed in "Theoretical and Methodological Underpinnings" while the data and methodology are covered in "Data and Methodology." "Presentation of the Main Results of the Principal Component Analysis" presents the empirical results which are further substantiated with insights into the applicability of the synthetic indicator in terms of determinants in "Applicability of the Synthetic Indicator: Identification of the Determinants of Support for Companies in the Selected Countries." "Conclusion, Policy Implications and Future Research Directions" concludes with implications (i.e., for scholars, practice, and policy), caveats, and future research directions.

Theoretical and Methodological Underpinnings

The approach we use to construct our synthetic indicator is based on seminal works of Benzécri (1973) and Asselin (2002). These authors build on static mechanics and apply the technique of factor analysis to obtain synthetic indicators of poverty. For example, Asselin (2002) and Diallo (2022), in their works on poverty, clearly define this approach in order to better understand the resulting theory.

Asselin (2002) and Diallo (2022) summarize the approach by considering the set of observations (n) of our population to which cloud of points (i) are attributed average weights. In space R^m where the cloud points are apparent, it can be illustrated by several dimensions or each time dimension is linked to an inertia which is considered relative. Total inertia (total dispersion) is the weighted sum of the distances between the average weight and the different points of the cloud. The general theoretical framework of multivariate analyses is based on this approach.

According to Asselin (2002), principal component analysis makes it possible to associate a weight or even a level of importance to each variable as well as to each modality of the variables. This is consistent with the approach to be adopted in this study on building our synthetic indicator of the quality of business support.

In light of the above, by adopting the approach of Asselin (2002), the synthetic indicator for an individual (i) takes the following functional form:

$$IS_{i,t} = \frac{1}{K} \sum_{k=1}^{k} \sum_{j_k}^{j_k} W_{j_k}^{k} I_{i,j_k}^{k} \tag{1}$$

where K is the number of variables retained in the analysis, $W_{j_k}^{k}$ denotes the weight or the standardized score of the jth category of the variable k on each axis retained from the PCA and I_{i,j_k}^{k} is a $0/1$ binary variable taking the value 1 if the individual (i) has the category j_k and 0 elsewhere. $W_{j_k}^{k}$ in this equation makes it possible to reflect the relative importance of the modalities on all individuals with respect to the dimensions or axes selected. Thus, the indicator of the quality of business support will appear as a combination of the indicators of the axes selected while considering the structure of the latter.

Based on the work of Minvielle (2003), the formula for the overall quality indicator for business support could be written as follows:

$$\mathrm{IQAE}_i = \frac{\sum_t^P \lambda_t * IS_{i,t}}{\sum_t^P \lambda_t} \tag{2}$$

where λ_t are the largest eigenvalues obtained from the axes selected for the principal component analysis (PCA), $\mathrm{IQAE}_{i,t}$ is the the synthetic indicator for the chosen axis t, and p the number of axes used for the PCA. The results obtained from the PCA are presented in the following section.

Given that in component factor analysis, the percentages of inertia explained by the principal axes are generally strongly underestimated, it is possible to obtain the actual adjusted percentages. Two corrections have been proposed to improve the percentages of inertia, explained by each axis, starting from the results obtained in the case of a correspondence factor analysis from Burt's table.[1] The first correction is from the seminal work of Benzécri (1979) who advises to consider the main axes whose eigenvalues are greater than the inverse of the number of active variables in the model, that is $1/k$.

According to Cloutier-Villeneuve and Robinson (2015), the correction of Benzécri (1979) increases the share of inertia explained by the first axes but tends to slightly overestimate this share. Using the properties of the Burt table and the interpretation of the AFC eigenvalues of this table, Benzécri (1979) proposed the following correction:

Select the ℓ eigenvalues greater than threshold $1/p$.
Calculate the corrected eigenvalues:

$$\widetilde{\lambda}_k = \left[\left(\frac{p}{p-1}\right)\left(\lambda_k - \frac{1}{p}\right)\right]^2 \tag{3}$$

with p being the number of variables.

The next step is to calculate the sum of the corrected eigenvalues and illustrate the scree of the corrected eigenvalues by plotting the percentage of corrected cumulative inertia.

To address the drawback related to the correction of Benzécri (1979), Greenacre (1993) suggested to evaluate the percentage of inertia compared to the average inertia of the blocks outside the diagonal of the matrix of Burt. This average inertia, denoted by $\overline{\psi}$, can be calculated as follows:

[1] A Burt table is a symmetric matrix of categorical variables obtained in a multiple correspondence analysis. Similar to the covariance matrix of continuous variables, it is the outcome of the inner product of a full disjunctive table. The complete disjunctive table is a representation of the qualitative with modalities replaced by binary variables, each corresponding to one of the modalities.

$$\overline{\psi} = \left[\left(\frac{p}{p-1}\right)\left(\sum_k \lambda_k^2 - \frac{n-p}{p}\right)\right]^2 \tag{4}$$

with p as the number of variables and n the corresponding number of observations. Thus, according to Greenacre (1993), the adjusted percentage of the principal inertia of each observation (Greenacre correction) would be obtained by the ratio:

$$\tau_k = \frac{\widetilde{\lambda_k}}{\overline{\psi}} \tag{5}$$

In summary, the Greenacre correction is based on the fact that there is an overestimation in the procedure of Benzécri (1979) which uses the total inertia for the correction of the distances between the variables on the principal axes, whereas, the technique of Greenacre instead uses average inertia, which solves the problem of artificial distance.

Data and Methodology

Data

The concept of the quality of support for businesses is based on certain parameters that we consider relevant and useful for assessing the level of functioning of support structures. Business support will be deemed to be of good quality when activities offered to businesses are systematically organized (see Appendix). The data used in this article come from a survey carried out by the authors between August and October 2021 in three countries of sub-Saharan Africa, namely, Cameroon, Burkina-Faso, and Ghana. These data were collected using a questionnaire consisting of three main sections.

This survey was carried out among 43 support structures currently in operation in Cameroon and recognized by the government, 18 in Burkina-Faso, and 19 in Ghana, for a total of 80 business support structures. The surveys revealed that these support structures made up of business incubators, incubators, nurseries, accelerators, business hotels, start-up studios, and manufacturing laboratories (FabLab) could sometimes house several of these models. Hence, the need to question the performance of support networks in the selected countries. This is even more relevant since this phenomenon can be observed in the majority of countries in sub-Saharan Africa.

These collected data contain a certain amount of general information including the gender of the founder, the gender of the current manager, the duration of the support, the number of women in the structure, the specificity of the structure, the language (French and/or English), affiliation (public, private, or both public and private), number of companies supported, business model (for-profit and not-for-profit). These variables will be introduced into the model as additional variables. In the second section of the questionnaire, we included a series of essential dimensions to assess the level of functioning of the support structures.

Finally, the third section relates to the service provision of the support structures interviewed, including training, mentoring, networks, business development, access to finance, market facilitation, gender and inclusion programs, and the engagement of entrepreneurs. The third section relates to internal capacity including strategy and leadership, staff and team, presence in the ecosystem, the installations, finances, and the management of entrepreneurs.

Table 1 below presents all the indicators and dimensions used in the PCA (active variables and additional variables) by specifying their names in the data file, their type (dichotomous or ordinal), and their minimum and maximum levels which consequently reflect their total number of modalities. The indicators, 18 in number, are presented according to their dimensions; these dimensions are 14 in number. For a better understanding, in the paragraphs that follow, some characteristics of these indicators are presented by identifying, among other things, the meaning of the relationship of their modalities with the quality of support given to companies. Consistent with the motivation of the study, Table 1 is also tailored to articulate how the selected indicators are consistent with SDGs.

First, it is apparent that among the selected variables, 28 are nominal in nature, taking values between 0 and 4. Generally speaking, the minimum value indicates the absence of an advantage relating to the support of companies. For example, the fact of not offering facilities to entrepreneurs such as, *inter alia*, workshops and training camps, acceleration programs; mentoring programs; networking events organized or shared; interaction between entrepreneurs and between entrepreneurs and government; easy connection; market preparation service; support for business processes; support provided to promote access to finance; market facilitation assistance; gender/inclusiveness programing, and transactional relationships.

Internally, the non-performance of business support structures is also characterized by the absence of: (i) a defined mission statement or mandate, a strategic growth or sustainability plan; (ii) an experienced and qualified management team with a strong motivation to learn or improve programs; (iii) an excellent combination of skills and expertise to meet current and anticipated needs; (iv) a strong culture of learning and innovation as well as an ongoing search for ways to improve team and efficiency with strategically operated collaboration; (v) an excellent human resource management system (with staff salaries set at a high level in order to attract and retain the right talent, job descriptions are clear, staff are assessed through formal reviews, and opportunities for professional development are regular); (vi) a strong and consistent brand image, a highly developed marketing strategy using multiple channels; (vii) a well-developed financial plans, constantly updated as well as fully integrated budget in operations, which are closely and regularly monitored, annual audit; and (viii) plans and measures have been taken to ensure multiple and varied sources of funding as well as a well-developed entrepreneur management plan (monitoring and evaluation).

In the underlying cases, when the variable has a minimum modality (which is 0), it will negatively contribute to the performance of business support structures. The 28 variables presented are nominal and include a maximum modality which is reflecting the importance that the support structure attaches to services or activities as well as the frequency of performance of the attendant activity or service.

Table 1 Selected indicators for principal component analysis and nexus with SDGs

SN	Dimension/variables	Name of the variable	Minimal modality	Maximal modality	Type of indicator	Linked to
Explanatory variables						
Training						
1	Workshops	Wshps	0	4	Nominal	SDG4
2	Bootcamps	Bootp	0	4	Nominal	SDG4
3	Accelerator program	Accelpr			Nominal	SDG4
Mentorship						
4	Mentorship program	Mentor	0	4	Nominal	SDG4
Networking of entrepreneurs						
5	Networking events	Neteven	0	4	Nominal	SDG17
6	Entrepreneur connectivity	Connect	0	4	Nominal	SDG17
7	Advocacy & government interaction	Advoc	0	4	Nominal	SDG17
Business development						
8	B2B connections	B2B	0	4	Nominal	SDG9
9	Support to get technology to market	Techno	0	4	Nominal	SDG9
10	Business process	Process	0	4	Nominal	SDG9
Access to finance						
11	Access to finance	Afin	0	4	Nominal	SDG8
Access to Market						
12	Market facilitation	Amar	0	4	Nominal	SDG8
Gender and inclusivity						
13	Gender & inclusion	Genincl	0	4	Nominal	SDG5
Engagement						
14	Entrepreneur engagement	Eng	0	4	Nominal	SDG8
Strategy and leadership						

Table 1 (continued)

SN	Dimension/variables	Name of the variable	Minimal modality	Maximal modality	Type of indicator	Linked to
15	Strategic vision	Visi	0	4	Nominal	SDG8
16	Leadership team	Team	0	4	Nominal	SDG8
Management team						
17	Staff skills & consultants	SSC	0	4	Nominal	SDG8
18	Organizational culture	Cultur	0	4	Nominal	SDG8
19	HR management	GRH	0	4	Nominal	SDG8
Presence in the ecosystem						
20	Communications & branding	Brand	0	4	Nominal	SDG9
21	Recognition & influence	R&I	0	4	Nominal	SDG9
Facilities & equipment						
22	Facilities & equipment	Facilit	0	4	Nominal	SDG9
Finances						
24	Financial health and funding model	Finhhum	0	4	Nominal	-
Management of entrepreneurs						
25	Pipeline development	Pdev	0	4	Nominal	SDG8
26	Selection criteria & process	Critepro	0	4	Nominal	SDG8
27	Graduation criteria	Gradcrit	0	4	Nominal	SDG8
28	Monitoring and evaluation	Moneval	0	4	Nominal	SDG8
Supplementary variables						
29	Gender of the founder	Gendf	1	3	Ordinal	SDG5
30	Gender of the current leader	Gendcl	1	3	Ordinal	SDG5
31	Duration of the support	Dursup	1	5	Ordinal	-
32	Number of women	Nwom	1	5	Ordinal	SDG5

Table 1 (continued)

SN	Dimension/variables	Name of the variable	Minimal modality	Maximal modality	Type of indicator	Linked to
33	Specificity of the structure	Specific	1	4	Ordinal	
34	Language	Lang	1	2	Ordinal	-
35	Affiliation	Affilia	1	4	Ordinal	-
36	Number of businesses supported	Nbensu	1	4	Ordinal	-
37	Business model	Busmod	1	2	Ordinal	-

Source: authors with data from the Nkafu Policy Institute (2021)

The additional or supplementary variables that we introduce into the model are all ordinal in nature and have a number of modalities that vary between two and five. For example, the variable on the number of women (Nwom), which has five modalities, is presented in the form of a quintiles where the top quintile (value 5) positively influences the performance of companies, unlike quartile 1 or quartile 2 (values 1 and 2) which has a relatively small effect on firm performance. The same is true for other variables such as the variable on duration of support (Dursup) which has five modalities, notably, less than 3 months (value 1), between 3 and 6 months (value 2), and more than 12 months (value 5). In reality, the duration of the support would have a positive effect on the quality of support.

According to Paturel (2000) and Berger and Soubaya (2019), quality support influences the performance of business support networks in accordance with three main criteria: the efficiency of the network (measured by the sustainability and results of the supported companies); the efficiency of the network (assessed by the ease and speed of access to the resources provided to creators) as well as the effectiveness of the network (which is assessed from the level of satisfaction of the actors involved). Table 2 below presents descriptive statistics on the variables used.

Methodology: Factor Solution Adequacy Index, Bartlett's Test, and Principal Component Analysis (PCA)

The synthetic indicator of the quality of support for companies in sub-Saharan Africa is built from principal component analysis (PCA) directly implemented using XLSTAT command which has the advantage of providing weights that take into account the variability of data in time. This indicator, is in the form of a single variable (common component) whose movements are highly correlated, given that they either participate or not in the realization or not of the same phenomenon, which here is the quality of support for companies.

The advantage of this PCA method lies in the fact that it makes it possible to obtain weights that effectively reflect the variability of the data. In other words, instead of relying on theoretical weightings, it is based on empirical weightings which result from an internal phenomenon governing the data which affects the overall movement of the data. Given the fact that these variables come from various fields and therefore reflect heterogeneity of measurement units, it is preferable to carry out a standardized PCA.

The Kaiser–Meyer–Olkin index, which is an index of the adequacy of the factorial solution in fact, tests whether the partial correlations between the variables are weak. The Bartlett sphericity test is used to assess whether the correlation matrix is an identity matrix, which would indicate that the factor model is not suitable. In other words, the KMO index makes it possible to judge the relevance or not of resorting to principal component analysis. It is calculated for all the variables and for each variable. It is therefore a summary indicator that enables a study to assess for all the variables and for each variable taken individually, whether the original correlations are greater than the partial correlations.

Table 2 Descriptive statistics

Variable	Observations	Min	Max	Mean	Std
Workshops	80	0	4	3.175	0.897
Bootcamps	80	0	4	2.200	1.400
Accelerator program	80	0	4	2.175	1.499
Mentorship program	80	0	4	2.800	1.267
Networking events	80	0	4	2.688	1.098
Entrepreneur connectivity	80	0	4	3.113	0.994
Advocacy & government interaction	80	0	4	2.538	1.242
B2B connections	80	1	4	2.663	0.941
Support to get technology to market	80	0	4	2.600	1.014
Business process	80	0	4	2.875	0.960
Access to finance	80	0	4	2.438	1.200
Market facilitation	80	0	4	2.638	0.958
Gender & inclusion	80	0	4	2.388	1.297
Entrepreneur engagement	80	0	4	3.225	1.031
Strategic vision	80	0	4	2.825	1.041
Leadership team	80	2	4	3.300	0.683
Staff skills & consultants	80	1	4	3.300	0.848
Organizational culture	80	1	4	3.300	0.683
HR management	80	0	4	2.713	0.930
Communications & branding	80	0	4	2.825	0.911
Recognition & influence	80	0	4	2.913	0.814
Facilities	80	0	4	2.350	1.213
Financial management	80	0	4	2.663	1.043
Financial health & funding model	80	0	4	2.438	1.029
Pipeline development	80	0	4	2.750	0.849
Selection criteria & process	80	0	4	3.188	1.068
Graduation criteria	80	0	4	2.700	1.237
Monitoring and evaluation	80	0	4	2.613	1.073
Language	80	1	2	1.238	0.428
Specificity of the structure	80	1	3	1.263	0.631
Affiliation	80	1	4	2.075	1.167
Business model	80	1	2	1.350	0.480
Gender of the Founder	80	1	3	1.688	0.648
Gender of the current leader	80	1	3	1.825	0.546
Number of women	80	1	5	2.275	0.927
Number of enterprises supported	80	1	4	1.788	0.990
Duration of support	80	1	4	2.913	1.058

Source: authors with data from the Nkafu Policy Institute (2021)

Thus, a variable that would not be correlated to any other should certainly be removed from the analysis, since we are interested in the common variance shared between the variables. KMO values greater than or equal to 0.8 are considered to

Table 3 KMO index

Kaiser–Meyer–Olkin measure of sampling adequacy	
Wshps	0.691
Bootp	0.784
Accelpr	0.816
Mentor	0.800
Neteven	0.723
Connect	0.744
Advoc	0.833
B2B	0.742
Techno	0.832
Process	0.782
Afin	0.896
Amar	0.765
Genincl	0.849
Eng	0.775
Visi	0.860
Team	0.896
SSC	0.785
Cultur	0.787
GRH	0.792
Brand	0.846
R&I	0.717
Facilit	0.674
Finmg	0.730
Finhhum	0.826
pdev	0.806
Critepro	0.810
Gradcrit	0.794
Monieval	0.880
KMO	**0.800**

Source: authors with data from the Nkafu Policy Institute (2021)

be good while those which are less than 0.5 are unacceptable (Glen, 2016). In this study, the KMO index (Kaiser–Meyer–Olkin) is 0.8, which is greater than 0.5. This confirms the acceptance of the sample of variables obtained. The results obtained from the KMO test are contained in the Table 3 below:

As for Bartlett's test, it is used to evaluate the null hypothesis, H0, that the variances of k samples drawn are identical, against the alternative hypothesis, H1, that at least two of the variances are different in the overall estimate of the variance. The results of Bartlett's test are contained in Table 4 below.

Since the calculated p value is less than the significance level alpha = 0.05, we reject the null hypothesis H0 and do not reject the alternative hypothesis. The test results thus show that at least two of the variances of the variables used are different.

Table 4 Bartlett test

Chi-square (observed value)	1010.673
Chi-square (critical value)	424.334
DF	378
p value (two-tailed)	< 0.0001
Alpha	0.050

Source: authors with data from the Nkafu Policy Institute (2021)

The following paragraphs define the dimensions that are part of our synthetic indicator while linking them to this theoretical concern.

In the following subsection, we first carry out a PCA which will enable us subsequently to remove the variables that are too closely related to each other and by extension, group together the rare modalities that are likely to occur. Once this step is completed, a synthetic indicator of the quality of business support for each company selected in the database will be constructed.

Presentation of the Main Results of the Principal Component Analysis

General Results that Are Adjusted and Unadjusted by the Corrections of Benzécri (1979) and Grenacre (1993)

Table 5 below presents the percentage and the cumulative percentage of the principal inertia (PI) in relation to the axes as well as the adjusted and unadjusted results according to the approaches of Benzécri (1979) and Greenacre (1993). The values observed in attendant tables measure the percentage of the variance explained by the model. The higher the percentage of inertia, the more the corresponding axis explains a large part of the total variance. The results adjusted by the Benzécri formula of the PCA are apparent.

The first two axes of the PCA express 82.53389% of the total inertia equal to 28 according to both the adjustment of Benzécri (1979) and Greenacre (1993). In other words, these first two axes reflect almost 82.53389% of the available information; the representation in the first factorial plane being more faithful to the relative positioning of the different specific indicators of the model and holds exactly 77.88509% of the total inertia. The general results of the principal component analysis are thus given as follows:

The inertia values are modified by the Benzécri correction that appears in Table 5. The first two axes represent approximately more than 82.53% of the total variance for the rate of Benzecri.

Figure 1 below provides the graphical representation of the factorial plan corresponding to the PCA. This representation makes it possible to view at a single glance, the main characteristics of a support for companies of better or lower quality with respect to the two axes, and this, for each of the modalities related to the

Table 5 General results of the principal component analysis (adjusted and unadjusted results)

	Unadjusted results			Results adjusted with Benzécri			Results adjusted with Greenacre		
	IP	IP (in %)	IP (in cumulative%)	IP	IP (in %)	IP (in cumulative%)	IP	IP (in %)	IP (in cumulative%)
1	8.607	30.73929	30.73929	77.88485	77.88509	77.88509	77.88485	77.88509	77.88509
2	2.124	7.585714	38.325	4.648784	4.648799	82.53389	4.648784	4.648798	82.53389
3	2.043	7.296429	45.62143	4.297392	4.297405	86.83129	4.297392	4.297405	86.83129
4	1.585	5.660714	51.28214	2.566895	2.567152	89.39845	2.566895	2.566903	89.3982
5	1.408	5.028571	56.31071	2.014625	2.014826	91.41327	2.014625	2.014631	91.41283
6	1.257	4.489286	60.8	1.598422	1.598582	93.01185	1.598422	1.598427	93.01125
7	1.049	3.746429	64.54643	1.103984	1.104094	94.11595	1.103984	1.103987	94.11524
8	0.957	3.417857	67.96429	0.913125	0.913216	95.02916	0.913125	0.913128	95.02837
9	0.866	3.092857	71.05714	0.743597	0.743671	95.77284	0.743597	0.743599	95.77197
10	0.841	3.003571	74.06071	0.699508	0.699578	96.47241	0.699508	0.69951	96.47148
11	0.827	2.953571	77.01429	0.676001	0.676069	97.14848	0.676001	0.676003	97.14748
12	0.779	2.782143	79.79643	0.597936	0.597996	97.74648	0.597936	0.597938	97.74542
13	0.669	2.389286	82.18571	0.434763	0.434806	98.18128	0.434763	0.434764	98.18018
14	0.582	2.078571	84.26429	0.324719	0.324751	98.50604	0.324719	0.32472	98.5049
15	0.550	1.964286	86.22857	0.288645	0.288674	98.79471	0.288645	0.288646	98.79355
16	0.504	1.8	88.02857	0.239728	0.239752	99.03446	0.239728	0.239729	99.03328
17	0.483	1.725	89.75357	0.219208	0.21923	99.25369	0.219208	0.219209	99.25249
18	0.435	1.553571	91.30714	0.175809	0.175827	99.42952	0.175809	0.17581	99.4283
19	0.407	1.453571	92.76071	0.15243	0.152445	99.58196	0.15243	0.15243	99.58073
20	0.339	1.210714	93.97143	0.102447	0.102457	99.68442	0.102447	0.102447	99.68317
21	0.302	1.078571	95.05	0.079434	0.079442	99.76386	0.079434	0.079434	99.76261
22	0.280	1	96.05	0.067351	0.067358	99.83122	0.067351	0.067351	99.82996

Table 5 (continued)

	Unadjusted results			Results adjusted with Benzécri			Results adjusted with Greenacre		
	IP	IP (in %)	IP (in cumulative%)	IP	IP (in %)	IP (in cumulative%)	IP	IP (in %)	IP (in cumulative%)
23	0.254	0.907143	96.95714	0.054159	0.054164	99.88538	0.054159	0.054159	99.88412
24	0.231	0.825	97.78214	0.043433	0.043438	99.92882	0.043433	0.043433	99.92755
25	0.187	0.667857	98.45	0.026776	0.026779	99.9556	0.026776	0.026776	99.95433
26	0.179	0.639286	99.08929	0.024198	0.024201	99.9798	0.024198	0.024198	99.97853
27	0.136	0.485714	99.575	0.012338	0.012339	99.99214	0.012338	0.012338	99.99086
28	0.121	0.432143	100	0.009136	0.009137	100	0.009136	0.009136	100

Source: authors with data from the Nkafu Policy Institute (2021)

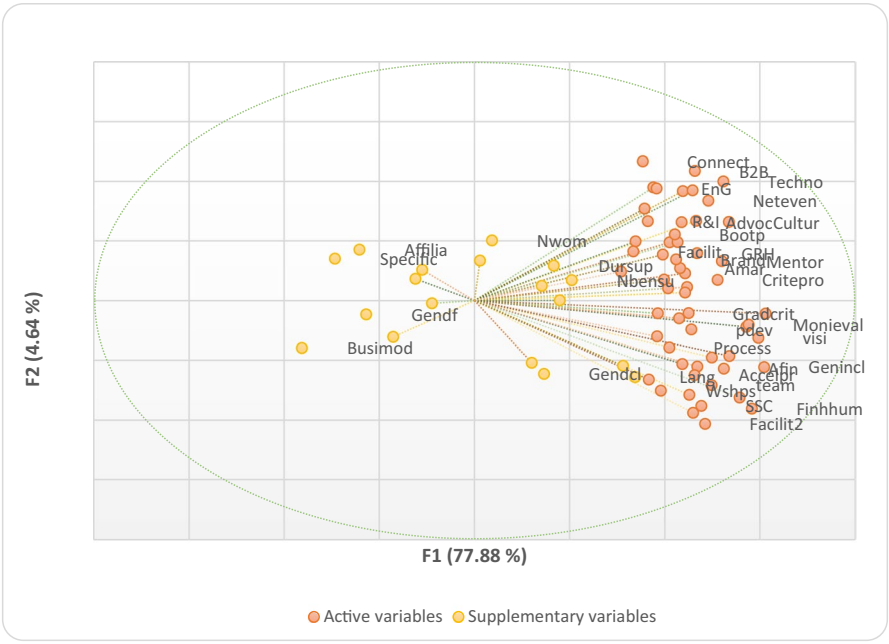

Fig. 1 Graphical representation of the variables on the F1 and F2 axes. Source: authors with data from the Nkafu Policy Institute (2021)

specific indicators selected. In the first axis (i.e., *x*-axis), the quality of support for companies improves with movement to the right, while in the second axis (i.e., *y*-axis), the quality of support business improves when with movement to the top. In fact, an improvement is seen as the value of the synthetic indicator increases. Figure 1 below shows the coordinates of each modality on the two main axes F1 and F2.

On the basis of this representation, it appears overall that the variables: relations between entrepreneurs (Connect), B2B connection (B2B), support for the commercialization of technology (Techno), engagement of entrepreneurs (Eng), networking events (Neteven), organizational culture (Cultur), training camp (Bootp), facilities and equipment (Facility), HR management (HRM), communications and branding (Brand), mentorship program (Mentor), market facilitation (Amar), and advocacy and interaction with the government (Advoc), are associated with a higher quality of support (the structures whose activities are based on these indicators generally form efficient networks of support for companies), while those focusing on the indicators form less efficient business support networks, namely, criterion of graduation (Gradcrit), continuous development (pdev), monitoring and evaluation (Monieval), strategic vision (visi), programing focused on gender and inclusiveness (Genincl), access to funding (Order), acceleration program (Accelp), management team (team), financial health and funding model (Finhhum), workshops (Wshps), staff and consultant skills (SSC), and financial management (Finmg).

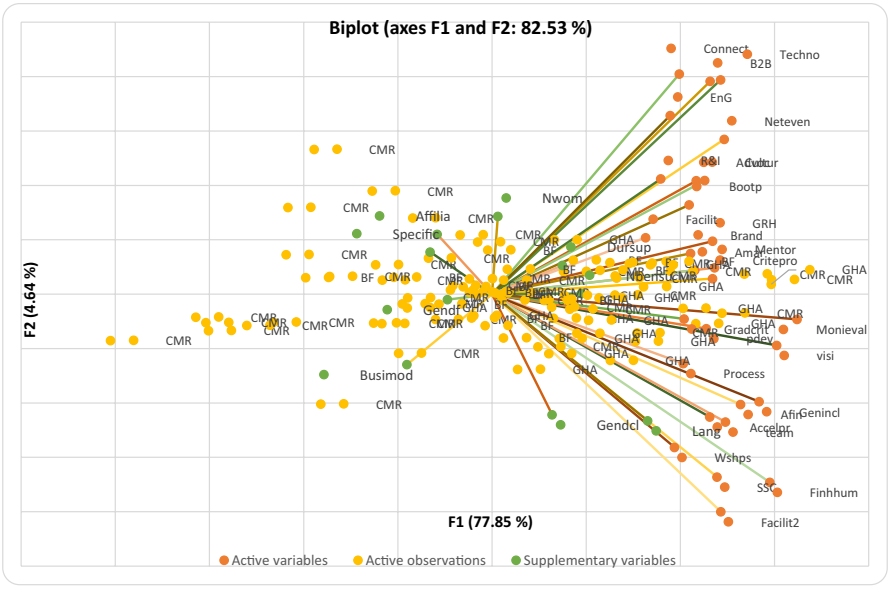

Fig. 2 Factorial map of the representation of the modalities on the scale of the quality of support for companies on axes F1 and F2. Source: authors with data from the Nkafu Policy Institute (2021)

The factorial plan therefore offers a synthetic perspective (cloud of points) of all the modalities in relation to our job quality index. Beyond this graphic representation, the PCA ultimately allows us to obtain the contribution of each of the 37 indicators retained in our statistical model not only exclusively in relation to the quality of support for companies but also with respect to their methods. The interpretation of the factors or axes is based on the analysis of the contributions and the quality of representation.

The contribution of a modality is its participation in the construction of an axis. The contribution is a function of the weight and the coordinates of the modality on the factorial axes. The analysis of the quality of the representation enables an assessment of whether a modality is well represented by an axis. These contributions represent the different "weights" that are subsequently employed in constructing the proposed synthetic indicator (Fig. 2).

The additional variables retained, even if they do not participate in the calculation of the eigenvalues and in the construction of corresponding axes, were used in the calculation of the synthetic indicator. All the categories of these variables are linked to the two axes. This link is statistically significant at the 5% level as evidenced by their respective test values on each of the axes which are all greater than 2 in absolute value. Employing the PCA enabled the study to obtain the weights of the variables as summarized in the table below (Table 6):

Contribution of Quality Indicators of Support According to the Axes

In this subsection, we present the percentage contributions of each of the quality indicators of support for companies according to their respective axis. The sum of the relative contributions of each indicator for each axis totals 100%. The percentage of information captured by the first axis is 77.88%, while the percentage for 4.64% corresponds to the second axis, for a total inertia of 88.53%. These results naturally show that the first axis influences the synthetic indicator more than the second.

Contribution of the Modalities of the First Axis

Figure 3 reveals that approximately 74% of the contribution of axis 1 is explained by indicators linked to the management and technical capacities of the support structure (48.35%) as well as to the services offered by the structure support for its entrepreneurs to help them develop their businesses (25.79%). Indeed, the following conditions explain a large part of the differences observed with regard to the quality of support: financial health and financing model of the structure (10.94%), financial management (9.645%), skills staff and consultants (8.209%), the existence within the structure of a program focused on gender and inclusiveness (7.482), the services offered by the structure to facilitate access of supported companies to financing (6.803), the expertise of the management team in terms of business support (6.74%), the internal capacity of the structure in terms of monitoring and evaluation (6.405%), the strategic vision of the structure (6.404%), the services offered in terms of training in the acceleration program (5.973), and workshops (5.537%).

Contribution of the Modalities of the Second Axis

For this second axis, which accounts for 4.64% of the total inertia, 72.75% of the contribution of the indicators relates in particular to: the capacity of the support structure to facilitate connections between entrepreneurs and external actors through the events of networking in particular (16.91%), the ability to facilitate business-to-business connections (9.92%), the ability to help entrepreneurs refine their product or service to launch and develop their businesses on the market (10.48%), the engagement of entrepreneurs (6.79%), organizational culture (5.77%), advocacy and interaction between government (5.46%), training services offered in the training camp (4.46%), influence of the structure in the entrepreneurial ecosystem (4.35%), and human resource management (4.12%). In general, these contributions by variable show that there are still significant efforts to be made in several areas to strengthen the performance of business support structures in the selected countries, both in terms of both the quality of services offered and the technical capacity of corresponding structures (Fig. 4).

Table 6 Determination of the synthetic indicator of the quality of business support in the selected countries

SN	Type of structure	ID	F1	F2	IQAE[a]
1	Incubator, accelerator	CMR	0.215	−0.221	0.129
2	Incubator, nursery	CMR	−2.540	3.795	−1.287
3	Manufacturing lab or space makers	CMR	−1.198	−0.928	−1.144
4	Incubator, accelerator, manufacturing lab	CMR	−0.477	0.564	−0.271
5	Incubator, accelerator	CMR	0.251	0.516	0.303
6	Incubator	CMR	3.785	0.852	3.205
7	Incubator, nursery, accelerator	CMR	−4.640	−1.029	−3.925
8	Incubator, nursery	CMR	−0.674	2.179	−0.110
9	Incubator, brooder, start-up factory	CMR	−2.471	1.085	−1.767
10	Incubator	CMR	−0.413	0.037	−0.324
11	Brooder	CMR	−0.829	0.318	−0.602
12	Incubator, brooder, start-up factory	CMR	−3.635	−4.037	−3.714
13	Incubator, nursery, start-up factory	CMR	−4.332	3.188	−2.844
14	Nursery, accelerator	CMR	−2.336	−1.082	−2.088
15	Incubator	CMR	−1.983	−2.172	−2.020
16	Incubator, brooder	CMR	−6.290	−0.843	−5.212
17	Incubator, nursery, brooder, start-up factory	CMR	2.915	1.137	2.563
18	Incubator, brooder	CMR	−6.019	−1.339	−5.093
19	Start-up factory, incubator	CMR	2.612	−0.028	2.089
20	Incubator	CMR	0.350	0.059	0.292
21	Nursery, accelerator, incubator	CMR	−1.681	2.802	−0.794
22	Incubator	CMR	−0.190	0.091	−0.135
23	Incubator, brooder	CMR	2.616	0.676	2.232
24	Incubator	CMR	−5.203	−1.147	−4.401
25	Incubator	CMR	−2.329	0.521	−1.765
26	Incubator, nursery	CMR	−6.074	−1.045	−5.079
27	Incubator	CMR	5.940	0.532	4.869
28	Nursery, accelerator	CMR	3.082	−1.421	2.191
29	Incubator	CMR	−4.372	1.457	−3.218
30	Incubator	CMR	−1.788	−0.135	−1.461
31	Incubator, start-up factory, FabLab, nursery	CMR	1.268	−0.476	0.923
32	Incubator	CMR	1.655	−0.547	1.219
33	Incubator, nursery, accelerator	CMR	2.646	0.596	2.240
34	Incubator, brooder, accelerator	CMR	−3.777	5.322	−1.977
35	Incubator	CMR	−1.348	1.330	−0.818
36	Incubator	CMR	5.362	0.744	4.448
37	Incubator, nursery, brooder	CMR	4.885	−0.696	3.781
38	Incubator	CMR	−1.905	−0.352	−1.598
39	Incubator, nursery, manufacturing lab	CMR	−8.098	−1.707	−6.833
40	Incubator	CMR	−0.303	1.925	0.138
41	Incubator, nursery, brooder	CMR	−3.448	0.651	−2.636

Table 6 (continued)

SN	Type of structure	ID	F1	F2	IQAE[a]
42	Incubator	CMR	1.520	0.833	1.384
43	Incubator, nursery, manufacturing lab	CMR	0.978	− 1.933	0.402
44	Incubator	CMR	− 2.512	− 1.060	− 2.225
45	Incubator	BF	− 1.125	− 0.364	− 0.974
46	Incubator	BF	0.328	0.922	0.446
47	Manufacturing lab, incubator	BF	− 0.087	1.624	0.251
48	Brooder, business hotels	BF	− 0.613	0.275	− 0.437
49	Incubator, manufacturing lab	BF	0.247	− 1.607	− 0.120
50	Nursery, brooder, business hotels, accelerator	BF	− 0.880	0.156	− 0.675
51	Incubator	BF	− 2.086	0.621	− 1.550
52	Incubator	BF	2.294	0.885	2.015
53	Start-up factory	BF	1.728	1.252	1.633
54	Manufacturing lab	BF	− 0.315	− 0.019	− 0.256
55	Brooder	BF	2.504	1.164	2.238
56	Accelerator	BF	− 3.956	0.612	− 3.052
57	Start-up factory	BF	3.700	1.206	3.207
58	Brooder	BF	− 0.478	0.078	− 0.368
59	Incubator	BF	− 0.432	− 0.873	− 0.519
60	Incubator	BF	− 0.144	− 1.158	− 0.345
61	Incubator	BF	1.113	− 0.232	0.847
62	Accelerator	GHA	3.367	1.080	2.914
63	Incubator	GHA	1.540	− 0.041	1.227
64	Incubator	GHA	1.209	− 2.187	0.537
65	Incubator	GHA	− 1.795	− 0.504	− 1.540
66	Accelerator	GHA	− 0.385	− 0.787	− 0.464
67	Accelerator	GHA	1.307	− 0.880	0.874
68	Accelerator	GHA	2.051	− 0.957	1.456
69	Incubator, accelerator	GHA	2.275	− 0.129	1.799
70	Incubator	GHA	3.222	0.276	2.639
71	Accelerator	GHA	4.329	− 1.082	3.258
72	Incubator	GHA	5.932	0.366	4.830
73	Incubator	GHA	1.805	− 1.441	1.162
74	Incubator	GHA	1.213	− 0.192	0.935
75	Accelerator	GHA	0.544	− 2.762	− 0.111
76	Incubator	GHA	1.323	1.999	1.457
77	Accelerator	GHA	3.049	− 1.733	2.102
78	Incubator	GHA	4.058	− 0.515	3.153
79	Incubator	GHA	1.432	− 1.627	0.826
80	Incubator, accelerator	GHA	2.515	− 2.434	1.536

[a]Index of the quality of business support

Source: authors with data from the Nkafu Policy Institute (2021)

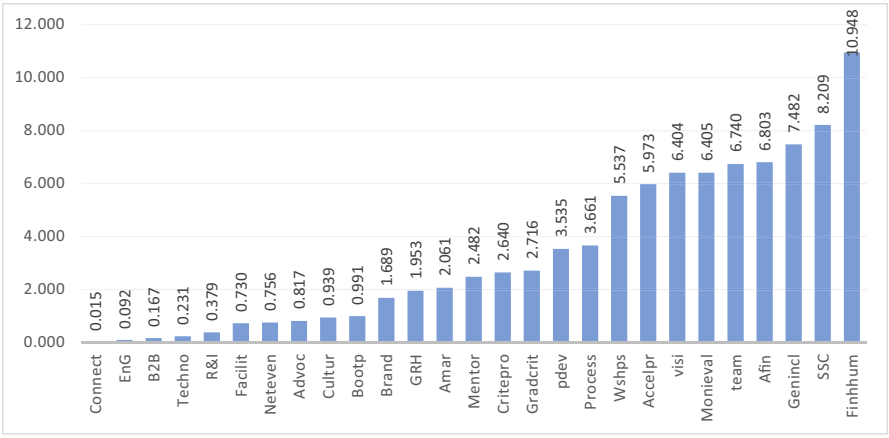

Fig. 3 Contribution (in %) of indicators to the first axis of the PCA. Source: authors with data from the Nkafu Policy Institute (2021)

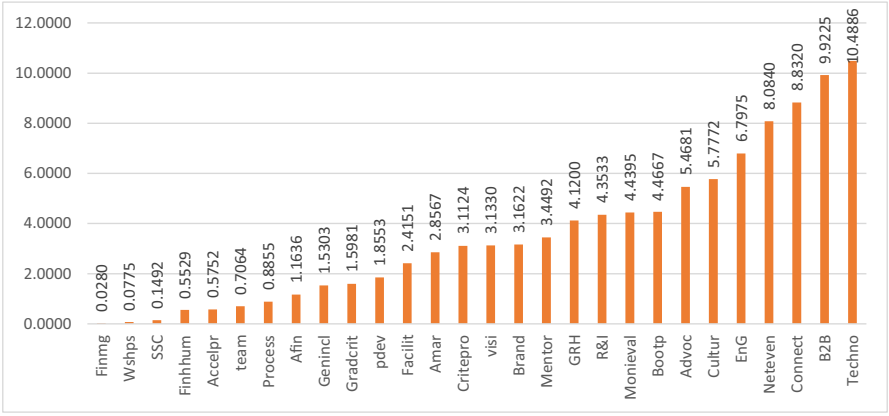

Fig. 4 Contribution (in %) of indicators to the second axis of the PCA. Source: authors with data from the Nkafu Policy Institute (2021)

Robustness Test

To assess the robustness of the synthetic indicator, Cronbach's alpha coefficient is employed, (Yunzhe et al., 2019) which allows the study to examine to what extent a group of variables represent a one-dimensional latent construct. Indeed, this reliability coefficient between 0 and 1 translates the degree of internal consistency (homogeneity) between variables which measure a particular phenomenon. This measurement is the result of inter-variable correlations: the higher these correlations, the closer Cronbach's alpha will be to the value of 1, which further indicates that the variables all measure the same latent variable (i.e., the same phenomenon as in the present context, the quality of the job).

Table 7 Alpha and Cronbach test

Cronbach's alpha statistics	
Cronbach's alpha	Standardized Cronbach's alpha
0.889	0.880

Source: authors with data from the Nkafu Policy Institute (2021)

Looking at the findings disclosed in Table 7, Cronbach's alpha calculated for PCA is 0.889 which is higher than the minimum value of 0.700 generally accepted in the literature (Costa et al., 2013; Greenacre & Blasius, 2006). Based on these results, the proposed/derived synthetic indicator of the quality of business support appears robust.

Monte Carlo Simulations

The values of the different variables used in this study to assess the quality of business support may not be as close as possible to reality. There are therefore uncertainties and risks inherent in the synthetic index constructed. Without taking into account the sensitivity and uncertainty associated with the variables used to determine the synthetic index of business support, the results obtained would be limited to the values used, without the possibility of identifying the critical factors. Exporting and updating the results would also be quite difficult. For this reason, if the business support structures were to bring new expertise to the businesses, it would be difficult to change the quality of the support.

The Monte Carlo simulation approach allows to take into account the uncertainty of the many variables involved, their interactions, and their impact on the quality of the medium. This method has been used by several authors such as Mahyar et al., (2016), Khelfaoui and Babahani (2019) and Zhang (2020) who have applied it to simulate the interactions between several variables in the presence of local or external fields; creating a large number of different random configurations. Therefore, our synthetic index constructed is associated with a probability distribution and becomes a quality instrument for improving the services offered by business support structures. Monte Carlo simulations offer the advantage of using a probability distribution for a given variable rather than a reference value (Boyle, 1977). In our case, a normal distribution is attributed to the synthetic index of business support constructed and each simulation is made up of 1000 and 10,000 iterations, likely to take different values. Figures 1 and 2 below show the simulations performed (Figs. 5 and 6).

The results obtained from the Monte Carlo simulations enable us to obtain the minimum and maximum values observed during the iterations, in addition to the standard deviation. We are thus able to reproduce the probability distribution of the quality of support of the companies in each treatment. The probabilities associated with the standard deviations of the iterations of the synthetic index are relatively low, which indicated that the values of the explanatory factors for business support in the selected countries are very close to their means.

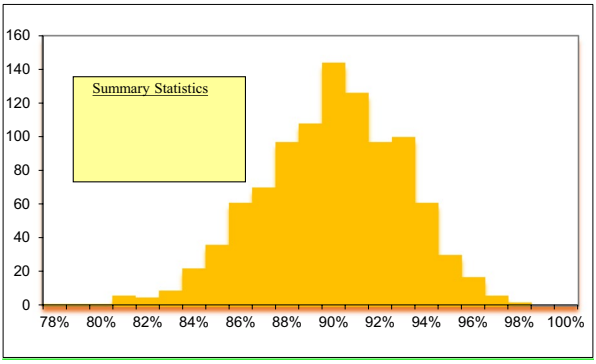

Fig. 5 Monte Carlo simulation (1000 iterations). Source: authors

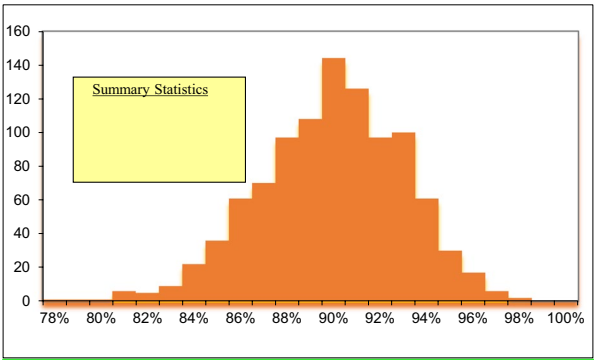

Fig. 6 Monte Carlo simulation (10,000 iterations). Source: authors

The average value obtained after 10,000 iterations is very nearly equal to the one obtained after 1000 iterations. The most reliable results are those obtained after 10,000 iterations. Indeed, the results obtained after 10,000 iterations indicate that for the synthetic index of the quality of support of businesses in the selected countries, the probability of occurrence is 89.97% against 89.91% for 1000 iterations.

In comparison with the maximum values, we notice that after 1000 iterations, there is a 98% chance that the synthetic index constructed is of higher quality. This probability is 99% when the simulations are obtained with 10,000 iterations. On the other hand, for the minimal values, after 1000 iterations, there is a 76% chance that the synthetic index constructed is of superior quality against 78% after 10,000 iterations. This information corroborates with that of Yildiz (2015), who introduced a Monte Carlo simulation (MCS) approach to risk analysis based on an entire life cycle representation of an investment project. Moreover, the author uncovers considerable advantages regarding content and methodology compared to ordinary net present value estimation or sensitivity analysis. Overall, there is a strong chance that the constructed synthetic index best appreciates the quality of business support in

Cameroon, Burkina-Faso, and Ghana. A high and positive value of the index would reflect a better quality of support, while a negative value would indicate a poor quality of support.

Applicability of the Synthetic Indicator: Identification of the Determinants of Support for Companies in the Selected Countries

The synthetic indicator of the quality of support for companies that we have constructed is used as a dependent variable in Table 8 in order to identify the determinants of the quality of support for companies in the selected countries. To achieve this, we use multiple linear regression analysis. This regression model was constructed in three stages. The first consists of only the characteristics related to the services offered; the second adjusts the model with respect to internal capacity variables, and the third integrates the additional variables.

The information criteria for the validity of the model show that the models are robust in light of (i) the significant Fisher statistics for the overall validity of estimated coefficients and (ii) the coefficient of adjustment which shows an explanatory power of above 80% in respective models. Concerns relating to multicollinearity are not also apparent because the highest coefficient is 0.646 which is below the threshold of 0.700 established by Kennedy (2008) and Asongu and Odhiambo (2022) for assessing of concern surrounding multicollinearity which could affect the signs of estimated coefficients and by extension and engender misplaced policy implications. The correlation matrix is available on request.

To be sure, we assess the signs of the two variables (financial management and financial health/funding model) reflecting a correlation coefficient of above 0.646 and confirms that the corresponding variables reflect the same signs, and hence, no concerns of multicollinearity are apparent. This further assessment is based on the fact that, when there is a conflict of substitution owing to concerns pertaining to multicollinearity, the two highly collinear variables emerge from the regression output with opposite signs because only one emerges with the expected sign (Asongu et al., 2021; Beck et al., 2003).[2] All remaining correlation pairs are below the 0.600 threshold.

In view of the results in Table 8, it appears that the following variables do not have a significant influence on the quality of support for companies in the selected countries or their level of performance: gender of the founder, gender of the current leader of the support structure, duration of the support, number of women in the support structure, the language spoken in the structure, the type of affiliation, the number of companies supported per year, and the business model. These insignificant variables are fundamentally based on the quality of the services offered in

[2] "*The political indicators sometimes enter negatively and significantly, perhaps because the predicted components of the political and adaptability channels are highly correlated. Although we did obtain the same results when we added many additional instrumental variables, we interpret these results cautiously and note that they do not imply that the political channel is unimportant in general*" (Beck et al., 2003, p. 671).

Table 8 General results of the determinants of the quality of business support in the selected Countries

Variables	(1)	(2)	(3)	Linked to
Services offered				
Workshops	0.120535		0.090131***	SDG4
Bootcamps	0.188716**		0.116008***	SDG4
Accelerator program	0.144824*		0.076121***	SDG4
Mentorship program	0.240325**		0.127468***	SDG4
Networking events	0.327235***		0.187598***	SDG17
Entrepreneur connectivity	0.089564		0.195492***	SDG17
Advocacy & government interaction	0.118862		0.140411***	SDG17
B2B connections	0.368905**		0.226623***	SDG9
Support to get technology to market	0.577736***		0.217906***	SDG9
Business process	0.239121*		0.116334***	SDG9
Access to finance	0.300645***		0.115953***	SDG8
Market facilitation	0.050921		0.153394***	SDG8
Gender & inclusion	0.384251***		0.117659***	SDG5
Entrepreneur engagement	0.107424		0.170295***	SDG8
Internal capacity				
Strategic vision		0.483232***	0.174340***	SDG8
Leadership team		0.369847***	0.180848***	SDG8
Staff skills & consultants		0.041006***	0.119554***	SDG8
Organizational culture		0.559121***	0.264027***	SDG8
HR management		0.120553***	0.180390***	SDG8
Communications & branding		0.021742***	0.163627***	SDG9
Recognition & influence		0.347043***	0.184688***	SDG9
Facilities		0.202961***	0.101148***	SDG9
Financial management		0.138028***	0.089951***	-
Financial health & funding model		0.258663***	0.132445***	-
Pipeline development		0.359986***	0.162091***	SDG8
Selection criteria & process		0.188746***	0.146778***	SDG8
Graduation criteria		0.214076***	0.101302***	SDG8
Monitoring and evaluation		0.429793***	0.189182***	SDG8
Supplementary factors				
Gender of the founder			−2.51e−05	SDG5
Gender of the current leader			1.91e−05	SDG5
Duration of support			2.92e−05	-
Number of women			4.74e−05	SDG5
Specificity of the structure			0.000209***	
Language			1.22e-05	-
Affiliation			−3.81e−05	-
Number of enterprises supported			6.14e−05	-
Business model			4.80e−05	-
Constant	−8.548391***	−10.73263***	−11.88106***	
Observations	80	80	80	

Table 8 (continued)

Variables	(1)	(2)	(3)	Linked to
Adjusted *R*-squared	0.854	0.806	1	
F-statistic	34.036***	24.558***	2.01e08***	
Prob (*F*-statistic)	0.000	0.000	0.000	

***,**, and *, significant levels at 1%, 5%, and 10%, respectively
Source: authors with data from the Nkafu Policy Institute (2021)

terms of training, networking, access to finance and market facilities, and on the management and internal technical capacity of the support structures.

To put the underlying approach to a more perspective one, it is apparent that a 10% increase in the number of training workshops organized by business support structures would improve the quality of support by 0.9 points. Likewise, a 10% increase in the number of networking events organized in order to consolidate the connections between the different actors of the entrepreneurial ecosystem would improve the quality of the support provided by the business support structure by around 2 points. Overall, considering an improvement of 10 percentage points in their efficiency, the variables that significantly influence the quality of support for companies in the selected countries are among the following: the organizational culture of the structure (2.6 points), the increase in B2B connections between entrepreneurs (2.3 points), access to technology (2.2 points), improvement of the monitoring and evaluation plan (1.89 point), presence in the ecosystem (1.84 points), the level of human resources management (1.803 point), and the effectiveness of the management team (1.808 point), *inter alia*.

Considering Table 1, which links the variables collected to SDGs 4, 5, 8, and 9, it appears that taking these objectives into account in business support practices in the selected countries would significantly affect the quality of business support.

As support structures are seen as a real opportunity for starting up and consolidating young companies (Gharbi & Torrès, 2013), our results show that taking into account sustainable development objectives (especially those to which the variables of the study are recorded in Table 1) in business support practices would significantly affect the quality of the underlying support. Hence, there is a need for countries to equip themselves with structures to support social entrepreneurs and thus improve sustainable and inclusive growth (Nomo et al., 2020). This result is consistent with those of authors like Kamdem et al. (2011) who show that support structures should also incorporate qualitative aspects (i.e., skills transfer to entrepreneurs), not least, because the attendant support cannot be exclusively limited to quantitative aspects consisting of increasing the number of support structures.

According to the authors, consideration of the quality of support to the detriment of the quantity of support structures justifies why some countries in sub-Saharan Africa such as Cameroon and Senegal are setting up more training and/or funding programs with the help of international collaborations as well as putting great emphasis on relational networks of entrepreneurs. This approach can be fully explained in the contemporary context marked

by changes which are disrupting the operating methods and value systems of companies, and which require a certain digital transformation (Storhaye, 2016). In this sense, Alper and Miktus (2019) are of the perspective that establishing a level-playing field for female entrepreneurs appears particularly important. In the same vein, Tsambou and Kamga (2021), after analyzing the impact of the adoption of innovations on the productivity of companies, have established that the introduction of new products (or services), accompanied by new organizational and marketing methods, has a greater effect on business productivity.

Moreover, the findings in this study provide business support structures with the means of effective support that is consistent with the realities they face in businesses. The attendant findings from corresponding authors thus confirm the existence of a number of key success factors in supporting businesses on the one hand and on the other, an adequate posture for such support. While many authors are supportive of the idea that the underlying boost for companies must be specialized, very few however insists on an evaluation of the intrinsic quality of the support framework, which would ensure the possibility of shifting from a policy focused on quantity to an approach based on quality (Frugier, 2014).

This is particularly the case with Aerts et al. (2007) who reveal that the performance of an incubator depends on the success of its incubators. The work that has emerged there mainly derives from that of Gasse and Tremblay (2007) which indicates that the purpose of support is to provide a means to accessing financial capital, human capital, and social capital; Nkakleu and Fouda Ongodo (2009) who examine the influence of support structures on management practices; Nkakleu et al. (2010), analyzing the role of support structures in the acquisition and development of the skills of entrepreneurs and managers of small businesses; Kamdem et al. (2011), who identify the forms and practices of entrepreneurial support likely to have an impact on the performance of very small businesses; Nkakleu et al. (2013), who are interested in the impact of support structures on the skills and performance of SMEs start-up; and Pouka (2018) and Pouka and Nomo (2017) who study the impacts of subcontracting and partnership stock exchange programs on the performance of SMEs in the industrial sector. Consistent with Allard et al. (2013), our study reveals that the creation of a framework conducive to learning, the development of knowledge and skills and/or technological improvements and innovations for entrepreneurs are undoubtedly the bases for improving the quality of support for businesses in Burkina-Faso, Cameroon, and Ghana.

Conclusion, Policy Implications, and Future Research Directions

A business incubator (i.e., support structure) provides the incubator (companies) with useful information for the deployment of the entrepreneurial processes, in particular the knowledge and skills essential to transform their business projects. Accordingly, in undertaking a business project (Brechet, 1994) and ensuring long-term management of its activity (Sammut, 2001), supporting businesses in sub-Saharan Africa remains a topical issue. Accordingly, most entrepreneurs are limited in their entrepreneurial and managerial actions and have very few resources, cognitive capacities, and skills to sustainably develop the companies they manage (Capiez & Hernandez, 1998). Given that the support of companies has a major impact for the survival of companies (Nkakleu

et al., 2013), the ecosystem is now recognized by various actors as an important leverage of value creation and economic development, not least, because it significantly influences the productivity and competitiveness of firms (Green & Sakamoto, 2000). However, in order to obtain the expected effects, it is important for the support structures to align their practices with the objectives of sustainable development; an alignment that is relevant in bringing about significant favorable changes to societies and overall improvement in the livelihood of individuals.

The objective of this paper has been to build a synthetic indicator of the quality of support for businesses in sub-Saharan Africa that would identify the factors that can contribute towards improving the quality of this support in the selected countries. The approach used to construct this synthetic indicator is inspired by the works of Benzécri (1973) and Asselin (2002) who use static mechanics and apply techniques of factor analysis. A principal component analysis was performed on the data collected by the Nkafu Policy Institute from 80 business support structures in Burkina-Faso, Cameroon, and Ghana. The study then built on the PCA technique to construct a synthetic quality of support indicator for companies and, by extension, show that the attendant synthetic indicator is positively influenced by all the variables of the study which are linked to the objectives of sustainable development. Our results are robust after controlling for variables related to the general characteristics of the support structure.

Our results are consistent with the thesis that taking sustainable development objectives into account in business support practices would significantly improve business performance in sub-Saharan Africa. The originality of the study stems from the fact that it considers specific SDGs (SDG4, SDG5, SDG8, and SDG9) and assesses their contribution to improving the quality of support for companies, a research area that has not been investigated hitherto by the extant contemporary literature. From these results, as discussed in the previous section, several recommendations emerge for all stakeholders in the entrepreneurial ecosystem. While it is appropriate for the support structures to integrate the SDGs into their practices, it is even more necessary for policymakers to set up effective monitoring and evaluation systems for the companies that have been supported. The challenge here is to assess the needs of constantly evolving entrepreneurs. It is therefore essential that governments put in place administrative, legal, and fiscal frameworks based on sustainable development objectives (i.e. in particular those taken into account by this study) which would promote innovation and entrepreneurship. In such a context, companies must have recourse to support structures which are able to provide pragmatic local solutions to many unsolved or partially solved problems.

The magnitude and significance of factors related to services offered, internal capacity, and those from supplementary factors provided in Table 8 are informative on how the constructed synthetic indicator is relevant for SDGs.

The principal drawback of this study is that the findings are relevant to the three countries from which the case studies were conducted, and hence, generalization of the findings across Africa should be done with caution. Moreover, the established nexuses are contingent on the availability of the quality socio-economic data retained in the analysis. Hence, while not all SDGs could be considered for the study, it is worthwhile for future studies to consider complementary indicators that reflect other SDGs, not integrated in the present study.

Appendix

Table 9 Business support structures deemed to be of good quality when activities offered to businesses are systematically organized

Name of variable	Signs	Definitions
Workshops	+	Systematically organizes workshops with a high and consistent quality of content and service, adapted to the stage of development of the company, to the sector and to the capacity building needs of entrepreneurs
Training camps	+	Systematically organizes bootcamps with a high and consistent quality of content and service, adaptation to the stage of development of the company, to the sector as well as to the capacity building needs of entrepreneurs
Acceleration program	+	Provides targeted training on new content, high-quality connections with external experts, and one-on-one support, encourages collaboration and cohort learning
Mentoring program	+	Provides high-quality mentoring matches, with a large mentor database, systematic training, and boarding of mentors and counselors, a strong track record of productive mentoring engagements
Networking events	+	Regularly invites and hosts networking events which are highly regarded and attended by various external stakeholders. Design and theme of events vary
Relations between entrepreneurs	+	Facilitates connections between entrepreneurs and external actors by allowing them to constantly exchange information, resources, technical advice, which concludes partnerships between them, a platform for the community
B2B connections	+	Facilitates business-to-business (B2B) connections, defined as linkages and partnerships between entrepreneurs and actors that help fill supply chain gaps and other gaps in business development and growth
Support for the commercialization of technology	+	Help entrepreneurs to refine their product or service to launch and develop their businesses on the market
Business process	+	Advises entrepreneurs to identify and track support focused on streamlining business processes to advance their products or services
Access to finance	+	Facilitates entrepreneurs' access to diversified financial sources (e.g., angel investor networks, impact investors, venture capital firms, NGOs/INGs/multilateral grant-making institutions), entrepreneurs are always proactively exposed to opportunities
Market facilitation	+	Provides exceptional market facilitation support, market information is always accurate and relevant, ability to provide specific support to various products/markets, support is continuous, consistent, and results oriented. Access to relevant contacts, entrepreneurs actually use them

Table 9 (continued)

Name of variable	Signs	Definitions
Programing focused on gender and inclusiveness	+	Develops a quality gender and inclusion program to equip targeted entrepreneurs with the opportunity to integrate groups that are underrepresented due to their gender, ethnicity, age, sexual orientation, their disability, or their poverty
Entrepreneur engagement	+	Establishes very genuine relationships with clients, based on mutual respect. Staff are perceived as optimistic, empathetic, and determined, and demonstrate strong proactivity in helping clients seize opportunities
Strategic vision	+	Has a strong vision and mandate, with activities that support execution, detailed strategic plan fully integrated with operations, budget and governance
Leadership team	+	Has a highly qualified management team with extensive experience and relevant credentials, keeping abreast with best practices in the incubation industry and has demonstrated commitment to improving and building programs
Staff and consultant skills	+	Has an excellent combination of skills and expertise to meet current and anticipated needs, consultants are used strategically to fill gaps
Organizational culture	+	Has a strong culture of learning and innovation, constant search for ways to improve the team and efficiency, collaboration exploited strategically
Human resource management	+	Establishes an excellent human resource management system, setting staff salaries at a high level to attract and retain good talent
Communications and branding	+	Establishes a strong and consistent brand image as well as a highly developed marketing strategy using multiple channels
Recognition and influence	+	Marked by a highly recognizable presence, receives requests to provide expert advice, appears regularly in the media on multiple channels, is always invited to participate in events relevant to the sector, close links with ecosystem players global, as evidenced by active interactions
Facilities and equipment	+	Has a modern coworking space and meeting rooms with high levels of connectivity and technology, training/seminar room, providing access to product testing facilities if required, entrepreneurs always use the space
Financial management	+	Has very elaborate financial plans, constantly updated, budget fully integrated into operations, performance closely and regularly monitored, annual audit

Table 9 (continued)

Name of variable	Signs	Definitions
Financial health and funding model	+	Has plans and measures that have been taken to secure multiple and varied sources of funding. Multiple agreements have been concluded for the long term, with sponsors/supports capable of ensuring continuity of operation and efficiency. The financial statements are accurate and reflect a positive outlook
Continuous development	+	Fosters a highly competitive entry of entrepreneurs as well as a solid, committed, and reputable alumni network
Criteria and selection process	+	Have well-defined and transparent selection criteria for entrepreneurs, emphasizing the assessment of business model, stage of product development, and entrepreneurial tendency. The process must be transparent and uniform, and the standard application is always used
Criteria and selection process	+	Has well-defined and transparent selection criteria for entrepreneurs, emphasizing the assessment of business model, stage of product development, and entrepreneurial tendency. The process must be transparent and uniform, and the standard application is always used
Monitoring and evaluation	+	Has a well-developed monitoring and evaluation framework, regularly collecting information on client performance, integrating results to improve services, and using a client resource management system

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Data Availability Data for this study are available upon request from the corresponding author.

References

Abreu, A., & Camarinha-Matos, L.M., (2008). A benefit analysis model for collaborative networks. *Collaborative Networks: Reference Modeling*. Springer, pp. 253–276.

Abreu, A., & Camarinha-Matos, L.M. (2011). An approach to measure social capital in collaborative networks. Working Conference on Virtual Enterprises. *Springer*, 29–40.

Aerts, K., Matthyssens, P., & Vandenbempt, K. (2007). Critical role and screening practices of European business incubators. *Technovation, 27*, 756–771.

Agarwal. S. K. (2020). Emerging technology intervention model of core support for inclusive rural growth: Social–economic–ecological interface building through innovative scalable solutions and effective delivery mechanism. In: Roy N., Roychoudhury S., Nautiyal S., Agarwal S., Baksi S. (eds) Socio-economic and eco-biological dimensions in resource use and conservation. *Environmental Science and Engineering*. Springer, Cham.

Akanle, O., & Omotayo, A. (2020). Youth, unemployment and incubation hubs in Southwest Nigeria. *African Journal of Science, Technology, Innovation and Development, 12*(2), 165–172.

Allard, F., Amans, P., Bravo-Bouyssy, K., & Loup, S. (2013). L'accompagnement entrepreneurial par les Coopératives d'Activité et d'Emploi : des singularités à questionner. *Management International, 17*(3), 72–85.

Allee, V., Schwabe, O., & Babb, M. K., (2015). *Value network sand the true nature of collaboration*. Meghan-Kiffer Press.

Alper, C. E., & Miktus, M., (2019). Digital connectivity in sub-Saharan africa: A comparative perspective. *International Monetary Fund* (IMF) (September 2019). Available at SSRN: https://ssrn.com/abstract=3482294 or https://doi.org/10.2139/ssrn.3482294. Accessed 2 Mar 2022.

Asongu, S. A., & Odhiambo, N. M. (2022). The role of mobile characteristics on mobile money innovations. *Quality & Quantity, 56*, 4693–4710.

Asongu, S. A., Biekpe, N., & Cassimon, D. (2020). Understanding the greater diffusion of mobile money innovations in Africa. *Telecommunications Policy, 44*(8), 102000.

Asongu, S. A., Biekpe, N., & Cassimon, D. (2021). On the diffusion of mobile phone innovations for financial inclusion. *Technology in Society, 65*, 101542.

Asselin, L.-M. (2002). *Pauvreté multidimensionnelle*. Canada: Québec, Institut de Mathématique Gauss.

Beck, T., Demirgüç-Kunt, A., & Levine, R. (2003). Law and finance: Why does legal origin matter? *Journal of Comparative Economics, 31*(4), 653–675.

Benzécri, J.-P. (1973). La place de l'a priori. *EncyclopediaUniversalis, Organum, 17*, 11–24.

Benzécri, J.-P. (1979). On the analysis of a table, one of whose columns has a predominant weight (in French). *Les Cahiers De L'analyse Des Données, 4*(4), 413–416.

Berger, D. L., & Soubaya, I. R. (2019). Female entrepreneurship and capacity building in developing countries: Case of Madagascar. In Capacity building in developing and emerging countries (pp. 151–180). *Springer*, Cham.

Bicaba, Z., Brixiová, Z., & Ncube, M. (2017). Can extreme poverty in sub-Saharan Africa be eliminated by 2030? *Journal of African Development., 19*(2), 93–110.

Boyle, P. P. (1977). Options: A Monte Carlo approach. *Journal of Financial Economics, 4*, 323–338.

Brechet, J. P. (1994). Du projet d'entreprendre au projet d'entreprise. *Revue Française De Gestion, 99*, 5–14.

Camarinha-Matos, L. M., & Macedo, P. (2010). Á conceptual model of value systems in collaborative networks. *Journal of Intelligent Manufacturing, 21*(3), 287–299.

Capiez, A., & Hernandez, E. M. (1998). Vers un modèle d'émergence de la petite entreprise. *Revue Internationale PME, 11*(4), 13–41.

Cloutier-Villeneuve, L, & Robinson S-F, (2015). Construction d'un indicateur synthétique de la qualité de l'emploi: résultats méthodologiques et empiriques, Québec, *Institut de la statistique du Québec.* p. 88.

Costa, P. S., Santos, N. C., Pedro Cunha, P., Cotter, J., & Sousa, N. (2013). The use of multiple correspondence analysis to explore associations between categories of qualitative variables in healthy ageing. *Journal of Aging Research., 12*, 30216. https://doi.org/10.1155/2013/302163.

De Bernardi P., & Azucar D. (2020). Entrepreneurial food ecosystem: strategic driver to boost resilience and sustainability. In: Innovation in food ecosystems. Contributions to management science. *Springer*, Cham.

Diallo, M. A. (2022). Subjective poverty and migration intention abroad: The case of Senegal. *African Development Review, 34*(3), 410–424.

Frugier, D. (2014). Faire évoluer la qualité de l'accompagnement à l'echelle d'une région. *Entreprendre Et Innover, 21*(22), 90–98.

Gasse, Y. &Tremblay, M. (2007). Mesures et pratiques de soutien d'accompagnement d'entrepreneurs: l'exemple d'une région canadienne. *5ème congrés de l'Académie de l'entrepreneuriat*, Canada, pp. 4–5.

Gharbi, V., & Torrès O. (2013). La dimension salutogène de l'accompagnement entrepreneurial. Communication presented at the 8e Congrès de l'Académie de l'Entrepreneuriat et de l'Innovation, Fribourg.

Glen S, (2016). Kaiser-Meyer-Olkin (KMO) Test for sampling adequacy from statistics how to.com: Elementary statistics for the rest of us! https://www.statisticshowto.com/kaiser-meyer-olkin. Accessed 2 Mar 2022.

Graça, P., & Camarinha-Matos, L. M. (2017). Performance indicators for collaborative business ecosystems —Literature review and trends. *Technological Forecasting & Social Change, 116*(2017), 237–255.

Green, A., & Sakamoto, A. (2000). *The place of skills in national competition strategies in Germany, Japan, Singapore and the UK, Report for the high skills project*. London: ESRC and Institute of education.

Greenacre, M. J. (1993). *Correspondence analysis in practice*. Academic Press.

Greenacre, M. J., & Blasius, J. (2006). *Multiple correspondence analysis and related methods* (p. 608). Chapman & Hall/CRC.

Gunasekaran, A., Patel, C., & Tirtiroglu, E. (2001). Performance measures and metrics in a supply chain environment. *International Journal of Operations & Production Management, 21*(1/2), 71–87.

Gunasekaran, A., Patel, C., & McGaughey, R. E. (2004). A framework for supply chain performance measurement. *International Journal of Production Economics, 87*(3), 333–347.

Haugh, H. (2020). Call the midwife! Business incubators as entrepreneurial enablers in developing economies". *Entrepreneurship & Regional Development, 32*(1–2), 156–175.

Jegede, O. O. (2020). Open development and scaling-up of clustered enterprises in Nigeria's informal sector. *African Journal of Science, Technology, Innovation and Development.* https://doi.org/10.1080/20421338.2020.1718363.

Kamdem, E. S., Nkakleu R., Ongodo M. F., Biboum A. D., &Ikellé R. (2011), Accompagnement des entrepreneurs : Genre et performance des très petites et petites entreprises en phase de démarrage dans les villes de Douala et Yaoundé (Cameroun). Edition du Codesia.

Kennedy, P. (2008). *A guide to econometrics*. Blackwell Publishing.

Khelfaoui, F., & Babahani, O. (2019). How to use the Monte Carlo simulation technique? Application: A study of the gas phase during thin film deposition. In (Ed.), Theory, application, and implementation of Monte Carlo method in science and technology. *In-tech Open*. https://doi.org/10.5772/intechopen.88559.

Kouam, J. C., & Asongu, S. A. (2022). Effects of taxation on social innovation and implications for achieving sustainable development goals in developing countries: A review of literature. *International Journal of Innovation Studies, 6*(2), 259–275.

Lorentz, H., Shi, Y., Hilmola, O.-P., Srai, J. S., Ramanathan, U., Gunasekaran, A., & Subramanian, N. (2011). Supply chain collaboration performance metrics: A conceptual framework. *Benchmark: International Journal, 18*(6), 856–872.

Mahyar, S. M., Mehrdad, B. A., & Ali, B. (2016). Application of Monte Carlo method in economic optimization of cogeneration systems – Case study of the CGAM. *Applied Thermal Engineering, 104*(04), 149. https://doi.org/10.1016/j.applthermaleng.

Masutha, M., & Rogerson, C. M. (2015). Business incubation for small enterprise development: South African pathways. *Urban Forum, 26*, 223–241.

Millette, S., Hull, C. E., & Williams, E. (2020). Business incubators as effective tools for driving circular economy. *Journal of Cleaner Production, 266*, 121999. https://doi.org/10.1016/j.jclepro.2020.121999

Minvielle, É. (2003)."De l'usage de concepts gestionnaires dans le champ de la santé. Le cas de la qualité hospitalière." *Revue française de gestion, Lavoisier, 146*(5), 167–189.

Nair, S., & Blomquist, T. (2019). Failure prevention and management in business incubation: Practices towards a scalable business model. *Technology Analysis and Strategic Management, 31*(3), 266–278.

Nkakleu, R., & Fouda Ongodo M. (2009). Influence des structures d'accompagnement sur les pratiques de gestion de 250 PME/PE camerounaises en phase de démarrage. *Communication au Colloque international sur la vulnérabilité des TPE et des PME dans un environnement mondialisé.* 11èmes Journées Scientifiques du Réseau Entrepreneurial.

Nkakleu, R., et al. (2010). Le marché de l'accompagnement au Cameroun et au Sénégal: regards croisés des porteurs et des portants durant la création et le démarrage. *Communication au X ième du CIFEPME*, *Bordeaux*, pp. 27–29.

Nkakleu, R., Tidjani B., Méfouté A., & Biboum A. D. (2013). Compétences des entrepreneurs et performance des PME en démarrage : La structure d'accompagnement a -elle un impact en contexte camerounais? *Actes, XXIVème congrès de l'AGRH,* pp. 10–12.

Nomo, T., Pouka, M., & AnjorinHoussou, A. (2020). L'influence de l'accompagnement entrepreneurial sur la performance de jeunes PME: une évaluation des structures camerounaises d'accompagnement. *Revue Congolaise De Gestion, 30*, 79–119. https://doi.org/10.3917/rcg.030.0079.

Obaji, N. O., & Olaolu, D., (2020). Evaluation study on the barriers to success of technology business incubation programme in Nigeria – The moderating role of government policy. *SSRN Paper*, 3518205.

Paturel, R., (2000). "Externalisation et entrepreneuriat, dans Histoire d'entreprendre, Les réalités de l'entrepreneuriat. Directed by T. Verstraete, EMS Editions. *Management and Society*, Caen, pp. 173–186.

Piot, G., Pouly, M., Cheikhrouhou, N., & Glardon, R., (2007). An estimation model for business benefits in horizontal collaborative networks. *Establishing the foundation of collaborative networks*. Springer, pp. 345–352.

Pouka, M. R. (2018). Politiques publiques et PME au Cameroun : Les impacts de Bourse de Sous -Traitance et de Partenariat sur la performance des PME du secteur industriel. Editions L'Harmattan.

Pouka, M. R., & Nomo, T. S. (2017). Politiques publiques et PME: BSTP Cameroun activateur de performance, dans Conference Proceedings CCSBE/CCPME Conference: The Development of SMEs and Entrepreneurship in the New Context of Globalization. Québec Canada.

Ramanathan, U. (2014). Performance of supply chain collaboration - A simulation study. *Expert System with Applications, 41*(1), 210–220.

Sammut, S. (2001). Processus de démarrage en petite entreprise : Système de gestion et scénarios. *Revue De L'entrepreneuriat, 1*(1), 51–76.

Spitzer-Shohat, S., Essa-Hadad, J., & Rudolf, M. (2020). Development of a novel social incubator for health promoting initiatives in a disadvantaged region. *BMC Public Health, 20*, 898. https://doi.org/10.1186/s12889-020-08990-1.

Storhaye, P. (2016). *Transformation, RH et digital: De la promesse à la feuille de route*. Éditions EMS. p. 256.

Surana, K., Singh, A., & Sagar, A. D. (2020). Strengthening science, technology, and innovation-based incubators to help achieve sustainable development goals: Lessons from India. *Technological Forecasting and Social Change, 157*, 120057.

Tchamyou, V. S., Erreygers, G., & Cassimon, D. (2019). Inequality, ICT and financial access in Africa. *Technological Forecasting and Social Change, 139*(February), 169–184.

Tsambou, A. D., & FombaKamga, B. (2021). Adoption d'innovations et productivité des entreprises en Afrique subsaharienne francophone: Cas du Cameroun, de la Côte d'Ivoire et du Sénégal. *Revue D'économie Industrielle, 173*, 107–160. https://doi.org/10.4000/rei.9920.

Yildiz, U. A. Ö. (2015). Economic risk analysis of decentralized renewable energy infrastructures–A Monte Carlo simulation approach. *Renewable Energy, 77*, 227–239.

Yunzhe, L., Alex, S., & Daniel, A. (2019). A principal component analysis (PCA)-based framework for automated variable selection in geodemographic classification. *Geo-Spatial Information Science, 22*(4), 251–264. https://doi.org/10.1080/10095020.2019.1621549,10(1080/10095020),pp.1621549,2019.

Zhang, Y. (2020). The value of Monte Carlo model-based variance reduction technology in the pricing of financial derivatives. *PLoS ONE, 15*(2), e0229737. https://doi.org/10.1371/journal.pone.0229737.

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