

The role of ecosystem for entrepreneurship development in Sudan

Ecosystem for
entrepreneur-
ship
development

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Abstract

Purpose – The components of the ecosystems differ from one ecosystem to another. The purpose of this paper is to identify the components of entrepreneurial ecosystem and investigate its role in entrepreneurship development in the Sudanese manufacturing sector.

Design/methodology/approach – The current study is explanatory in nature and designed to be cross-sectional, using a quantitative approach. Questionnaires were used to collect data from a stratified sample, ten industrial subsectors drawn from the total population of the study. It includes 106 manufacturing firms, all located in Khartoum State. Data are analyzed with help of exploratory factor analysis and multiple regression model.

Findings – Among the major findings is that the relationship between the entrepreneurial ecosystem and entrepreneurship development was found to be significant in six factors, namely: finance, government policy, human capital, infrastructure, research and development and innovation and regulatory framework, whereas it was insignificant in three factors, namely; culture, market and support services. These former factors explain 65.8% of the variation in entrepreneurship development.

Research limitations/implications – The cross-sectional nature of the study entails that its conclusions be limited to relevant parties.

Practical implications – In conclusion, a broad process to develop entrepreneurship ecosystem initiatives is proposed alongside the crucial roles that governments and other stakeholders should play.

Originality/value – This paper provides the most influential factors in the entrepreneurial ecosystem in Sudan. The study will be among the first studies that focuses on evaluating the existing entrepreneurial ecosystem in Sudan, given that relatively little systematic efforts have been devoted to examine the relationship between ecosystem and entrepreneurship development in Sudan.

Keywords Sudan, Entrepreneurial ecosystem, ANDE framework, Entrepreneurship development

Paper type Research paper

1. Introduction

Entrepreneurship plays an important role in economic development, but its decision-making does not occur in isolation from the local context in which entrepreneurs operate (Audretsch and Belitski, 2016). As Firman (2014) points out, creating a local context that is conducive to entrepreneurship and economic development requires a myriad of public and private decisions to formulate a character of place.

Understanding the entrepreneurial environment aids in the identification of factors that promote and support entrepreneurs' actions, contributing to the development and well-being of not only themselves and their immediate communities, but extend to positively affect the economy as a whole (Luskova *et al.*, 2015).

Furthermore, the Coduras *et al.*, 2010 report expresses a statistically significant association between entrepreneurial activity at the national level and subsequent rates of



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economic growth. GEM data also indicates that there are no countries with high levels of entrepreneurship and low levels of economic growth (Edoho, 2015).

Consequently, in order to stimulate entrepreneurship, various steps are to be taken; initially, to map and measure the existing entrepreneurial ecosystem (ANDE, 2013) and eliminate obstacles to growth and development in the field of entrepreneurship. It is also important to balance risks and benefits in the field and formulate a society that appreciates entrepreneurs' work and encourages young people to pursue business endeavors (Luskova *et al.*, 2015).

A variety of models for entrepreneurial ecosystems with different components have recently been emerging. For instance, Isenberg (2010) presents entrepreneurial ecosystem domains, which include conducive culture, enabling policies, leadership, availability of finance, quality human capital, venture-friendly markets for products, in addition to a range of institutional and infrastructural supports. The Levie *et al.* (2014) identifies seven similar components: markets, culture, education and training, regulatory framework and infrastructure, funding and finance and human capital.

The emerging perspectives of entrepreneurial ecosystems synthesize and effectuate to highlight the interaction between entrepreneurs, communities surrounding them and the potential for creative resource acquisition and utilization made possible through these communities. Empirical work on how this process actually unfolds remains scarce (Björklund and Krueger, 2015). Moreover, as asserted by Simatupang *et al.* (2015), the concept of an entrepreneurial ecosystem and associated empirical research have remained undertheorized. Therefore, what remains lacking is a framework that offers the entire range of action that can lead to greater degrees of sustainability (Lichtenstein, 2011).

In the case of Sudan, entrepreneurship faces a plethora of obstacles and problems related to the entrepreneurial environment such as: lack of quality education, detrimental government policies, unfavorable financial circumstances, insufficient business support services, unavailability of incubators and unsupportive, discouraging culture. According to the findings of a study conducted by Gangi (2015), universities are insufficient in performing their role as providers and enablers of the entrepreneurial environment and as a stimulus to students' entrepreneurial intent and aspirations. Doing business sheds light on how difficult it is for local entrepreneurs to open and run small to medium-size businesses while complying with relevant regulations. According to the World Bank's Doing Business Report (2016) and related studies also conducted by the World Bank, entrepreneurial activity in Sudan is quite poor in comparison to other countries in the region (ranked 159/189 in 2015).

A survey by the Abubakar (2015) indicates that entrepreneurs consider the shortage or unavailability of finance a major obstacle to their activities, and Sudan is no exception. In spite of the Bank of Sudan's adoption of the microfinance policy and its direction to all commercial and specialized banks to allocate 12% of their portfolios to finance small businesses (www.cbos.gov.sd), the actual amount for financing small and medium enterprises (SMEs) represents only 5% of banks' portfolios overall. Additionally, institutional arrangements that support markets are either absent or weak.

There is almost no cultural concept of private business establishment after graduation. Instead, students almost always seek employment and pursue occupations after obtaining degrees. Therefore, there exists a need to create and encourage this culture through higher education institution and proper advertising media (Elfadel, 2016).

The role of supporting programs is poorly understood and characterized by little conceptual or empirical discussion regarding the manner in which support programs contribute to the development of successful entrepreneurial ecosystems. Incubators in Sudan, as mentioned by Ibrahiem (2016), possess negative attitudes toward entrepreneurs and focus mainly on employment rather than entrepreneurship, in addition to that, the country faces many problems in this regard, including but not limited to: the absence of adequate training

standards, ignorance of proper trainee selection methods, poor training programs and lack of links between the incubators and the market. These problems are yet to be addressed in a satisfactory manner and, according to the researcher's own experience and knowledge, regardless of some scattered efforts that were focused on addressing the impact of some particular individual factors, no comprehensive studies have been launched so far to test the components of the entrepreneurial ecosystem in an attempt to address key barriers to Sudan's entrepreneurial development. The study's significance is therefore apparent based on the fact that entrepreneurial ecosystems are rarely explored in developing nations, and Sudan is no exception.

The paper is structured as follows: the second part explores literature on the entrepreneurial ecosystem and outlines its components while developing this study's hypotheses. The section that follows details research methodology and is followed by data analysis and study results. Then, a discussion of the study's findings ensues and finally concluding comments along with limitations, future research directions and recommendations are provided in the final section.

2. Literature review

2.1 *Entrepreneurial ecosystem*

Literature review reveals several definitions for entrepreneurial ecosystems. The concept of an entrepreneurial ecosystem dictates that entrepreneurship takes place in a community of interdependent actors (Stam, 2015). The entrepreneurial ecosystem approach has been in place only during the past eight years, brought to light in 2010 by Professor Daniel Isenberg of Babson College through an article in the Harvard Business Review (Isenberg, 2010)

The essential idea of an entrepreneurship ecosystem lies in the creation of a conducive environment supporting innovation, the creation of new, successful firms and to match sustainable employment growth goals within a specific geographic region (Simatupang *et al.*, 2015). Isenberg (2010) points out that opportunities are not pursued in isolation of their context, this is supported by Mazzarol's (2014) assertion, which states that the concept of an entrepreneurial ecosystem refers to the interaction that takes place between various institutional and individual stakeholders fostering entrepreneurship, innovation and SME growth. The entrepreneurial ecosystem is a concept that is fundamentally spatial – and centrally local (Malecki, 2018).

2.2 *Hypotheses development*

This study used the Aspen Network of Development Entrepreneurs (ANDE) framework indicators as a guiding source, which is tailored and modified to fit the local context.

2.2.1 Human capital. Education represents the main factor that provides individuals with the degrees and skills required of them in order to practice jobs, besides specific entrepreneurship training (Akhuemonkhan *et al.*, 2013). Furthermore, entrepreneurship education is intended to change beneficiaries' orientation and attitude, equipping them with the skills and knowledge necessary to start and manage their own businesses (Ekankumo and Kemebaradikumo, 2011).

In the same context, Mohamad *et al.* (2019) state that entrepreneurship education plays an essential role in cultivating entrepreneurial thinking, entrepreneurial attitudes and rising entrepreneurial skills to mold a person to become entrepreneur. Moreover, the introduction of entrepreneurial learning in science has been able to produce sustainable technological growth (Arfin, 2018).

Therefore, drawing upon these concepts is the study's first hypothesis:

H1. There is a statistically significant relationship between the human capital and entrepreneurship development.

2.2.2 Culture. A critical element, culture, can either foster collaboration and innovation or prevent effective knowledge sharing. Its possible negative role can be detrimental because

connecting potential entrepreneurs to networks offering resources and mentoring has always been an essential part of the culture for innovation and entrepreneurship (Kanter, 2012). Additionally, Aaltonen (2016) states that several examples show how national culture shapes potential entrepreneurs' tendency to create businesses and to innovate. As noted by Mazzarol (2014), Mazzarol (2014) specifies that there needs to be a culture that is tolerant of risk and failure and willing to champion entrepreneurial success with role models of individuals and firms who can serve to inspire and motivate others. Moreover, Fritsch and Wyrwich (2018) state that persistence of entrepreneurship over time specifies the role of a region-specific "culture" agreed as an informal institution that changes only gradually and over rather long periods of time. Therefore, local cultural heritage embedded in the community regarding entrepreneurship is indeed an important and valuable source of encouragement for a new venture creation process (Summatavet and Raudsaar, 2015).

Accordingly, the following hypothesis is formulated:

- H2. There is a statistically significant relationship between culture and the entrepreneurship development.

2.2.3 Public policy. Public policy comprises courses or patterns of action developed and implemented by public officials to achieve particular goals (Edoho, 2016). To this effect, the Levie *et al.* (2014) reported that the more policymakers understand what entrepreneurs consider important, the greater the potential for policies to be better aligned with the actions of companies.

The current study aligns its hypothesis with the findings of the Levie *et al.* (2014) and hypothesizes the following:

- H3. There is a statistically significant relationship between government policy and entrepreneurship development.

2.2.4 Finance. It has been observed that more developed financial systems allow easier access to finance. Several studies have found that financial development exerts a significantly positive impact on economic growth (Kasseeah, 2016). Moreover, Abubakar (2015) maintained that about 45% of firms in Sub-Saharan Africa recognize lack of finance as a key obstacle to their business, relative to 13% in OECD countries. Based upon the aforementioned literature, the current study proposes the following hypothesis:

- H4. There is a statistically significant relationship between the availability of finance and entrepreneurship development.

2.2.5 Business support services. There are multiple types of support that must be emphasized for the promotion of entrepreneurship. Mazzarol (2014) states that "Entrepreneurial actions" do need to be facilitated where possible, via soft and hard infrastructure such as mentoring and support services, education courses, incubators, coworking spaces, networking forums and accelerator programs. As noted by Brown *et al.* (2019), accelerators seek to provide help to scale up a fledgling business, rather than to launch ventures.

In light of the extant literature, the present study proposes the following hypothesis:

- H5. There is a statistically significant relationship between business support services and the entrepreneurship development.

2.2.6 Market. Recent studies, as well as early research on entrepreneurship, have accentuated a positive relationship between entrepreneurial development, economic growth, prosperity, wealth creation and the role of markets in driving this process (Abubakar, 2015). Additionally, access to markets, both domestic and foreign, plays a significant role in driving entrepreneurial activities according to Kshetri (2014). Consequently, this study proposes the following hypothesis:

H6. There is a statistically significant relationship between the markets and entrepreneurship development.

2.2.7 Research and development and innovation. For the past 100 years, technological innovation and entrepreneurship have been viewed as essential sources of business success and of national economic development, based on the creation of high-value-added jobs and leadership in global markets (Ding and Abetti, 2003). Environmental problems will not be solved solely by innovations, which create new products and services, but also through the creation of new ways for society to answer the question of “How should we live?” (York and Venkataraman, 2010). Additionally, Elia *et al.* (2020) show that digital technologies have nowadays a significant impact on how new business ventures are imagined and created.

Based on the preceding literature, this paper assumes the following hypothesis:

H7. There is a statistically significant relationship between the research, development and innovation on one side and the entrepreneurship development on the other side.

The relationship between these variables is conceptualized in Figure 1.

3. Research methodology

The study uses descriptive and explanatory designs to conduct quantitative analysis. The population in this study is all Sudanese manufacturing firms (private manufacturing with an active membership of the Federation of Sudanese Manufacturing (2016, 2017)). The method of stratified sampling is employed, and a survey is conducted among manufacturing firms in Sudan (ten industrial subsectors). A total of 106 firms completed the survey.

Both primary and secondary data were collected. The research starts data collection utilizing a pilot test in order to identify the key components of the entrepreneurial ecosystem in Sudan. From the literature reviewed and the different models for entrepreneurial ecosystem, 16

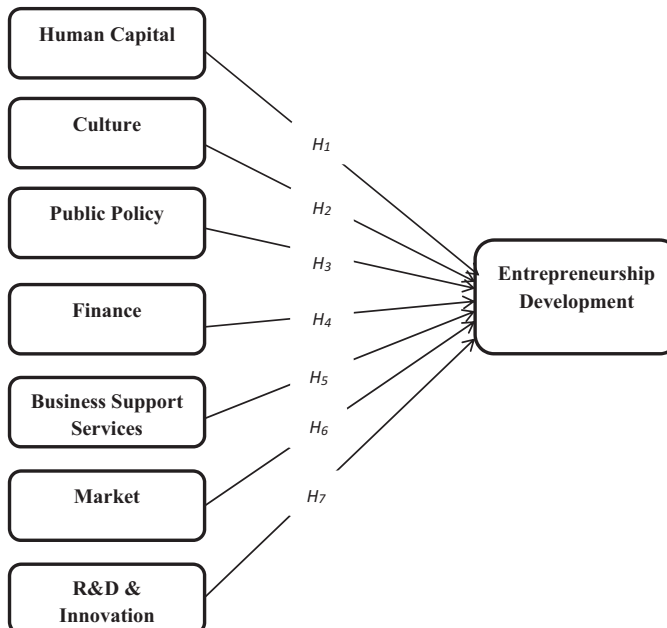


Figure 1.
Conceptual model

factors are identified as components for the ecosystem. A pilot test with 35 entrepreneurs and experts in the entrepreneurial environment is conducted to determine the factors that represent the entrepreneurship ecosystem in Sudan, then a ranking process of these factors follows. The top seven factors are identified as components of the ecosystem in this study, which include: human capital; business support services; finance; government policy; markets; culture; and research and development and innovation. A structured questionnaire was designed to gather data. Top-level managers were identified as the key informants.

4. Data analysis and results

Initially, bivariate correlations were computed among entrepreneurial ecosystem and entrepreneurship development variables. Afterward, a factor analysis is performed for entrepreneurial ecosystem and entrepreneurship development. All hypotheses are tested using multiple regression analyses.

4.1 Factor analysis

A factor analysis is performed to outline the most important factors that significantly influence entrepreneurship development in Sudanese manufacturing firms. Factor analysis was conducted using the principal component extraction method to classify data into major components. As indicated by the correlation matrix presented in [Table 1](#), multicollinearity is not a problem here.

Based on ecosystem components, factor analysis indicates that these factors explain (67.70%) of the total variance. Only factors with eigenvalue loading greater than 1.0 were extracted since these are the ones expected to be more reliable ([Hair et al., 2010](#)). Factor analysis was applied on the 52 items used to measure entrepreneurial ecosystem constructs. [Table A1](#) shows the summary of factor analysis results for the entrepreneurial ecosystem, loaded on nine components, namely finance, infrastructure, market, culture, research and development and innovation, policy, human capital, regulatory framework and support services.

Factor analysis was similarly utilized on the 11 items relevant to the entrepreneurial development. [Table A2](#) showcases the summary of the factor analysis results for entrepreneurship development, upon which the impact of three components, with eigenvalues exceeding 1.0, is inspected. These three factors cumulatively captured 58.3% of the total variance in the data. For the purpose of this study, the three factors were considered as one construct and accordingly computed to form one variable.

From the results of factor analysis, it is apparent that ecosystem components and entrepreneurship development variables have to be adjusted. Thus, ecosystem items are factored into nine components, instead of the initially conceptualized seven, meaning: two variables have been added to the ecosystem construct (infrastructure, regulatory framework). On the other hand, the dependent variable (entrepreneurship development) items, as previously indicated, and for the purpose of the study, remain unchanged following factor analysis, because the three variables were computed into one variable as conceptualized. Accordingly, there is a need to perform modification and proper calibration on the study's theoretical framework to reflect change in the independent variables.

Based on the modified theoretical framework, the hypotheses related to entrepreneurial ecosystem need to be restated. The restated hypotheses reflect the addition of infrastructure and regulatory framework as new variables related to the ecosystem construct.

4.2 Reliability analysis

To examine reliability, this study used Cronbach's alpha as a diagnostic measure. The results of the reliability analysis summarized in [Table 2](#) confirm that all scales display satisfactory levels of reliability where Cronbach's alpha exceeds its minimum acceptable value of 0.6 ([Sekaran and Bougie, 2009](#)).

Variables	DV	POL	SUP	FIN	RD	REG	MRK	HC	CLT	INF
DEVALL (DV)	1									
POLICE (POL)	0.518**	1								
SUPPORTS (SUP)	0.484**	0.221*	1							
FINANCE (FIN)	0.611**	0.364**	0.265*	1						
RANDDD (RD)	0.235**	0.182*	0.039	0.135	1					
REGULAR (REG)	0.292**	0.381**	0.349*	0.395**	0.046	1				
MARKET (MRK)	0.320**	0.275*	0.388*	0.257**	0.064	0.437**	1			
HUMANC (HC)	0.676**	0.309*	0.701*	0.313**	0.039	0.266**	0.288**	1		
CULTURE (CLT)	0.428**	0.167*	0.449*	0.338**	-0.039	0.410**	0.479**	0.486**	1	
INFRAST (INF)	0.371**	0.167*	0.352*	0.184*	-0.026	0.295**	0.262**	0.344**	0.298**	1
Note(s): Level of significance: * $p < 0.05$, ** $p < 0.01$, $N = 106$ (2-tailed)										

Table 1.
Person correlation
coefficient for all
variables

4.3 Descriptive analysis

Descriptive statistics such as the mean and standard deviation are calculated to describe all variables (independent, dependent) under study. Data collection implies a normal distribution, which is convenient for analysis using the methods administered in this study. Table 3 demonstrates the mean and the standard deviation of the entrepreneurial ecosystem's nine components. The table reveals that Sudanese manufacturing firms' dependence falls mostly on government policies (mean = 3.53, standard deviation = 1.295) and least on development and innovation (mean = 1.5, standard deviation = 0.337). Given that the scale used in this study is a five-point scale in which 1 represents no obstacle and 5 represents a severe level of obstruction, it can be concluded that Sudanese manufacturing firms are highly dependent on government policies, infrastructure and human capital, while above average on other factors.

Table 4 presents the mean and the standard deviation values of entrepreneurship development. The table illustrates that the mean scores of entrepreneurship development are notably over the mid-point with a low level of variance (mean = 2.862, standard deviation = 0.66562).

The results indicate that on average, during the last three years, the Sudanese manufacturing firms sampled have achieved stable average development.

4.4 Model formulation and estimation

This study assumes a linear model based on knowledge from reviewed literature on the relationship between entrepreneurship development and entrepreneurial ecosystem. Entrepreneurship development was assumed to be a function of ecosystem factors as follows:

EC = (entrepreneurial ecosystem factors);

$$\gamma = f(\chi^i, \beta)$$

Where; β is the intercept

χ^i = the independent variables

γ = the dependent variable

β_0 is y – intercept and

ε = is the random error

Thus, the regression model is as follows:

$$ED = \beta_0 + \beta_1\chi_1 + \beta_2\chi_2 + \beta_3\chi_3 + \beta_4\chi_4 + \beta_5\chi_5 + \beta_6\chi_6 + \varepsilon \tag{1}$$

Table 2.
Cronbach's alpha for
study variables

Construct	Variable	Number of items	Cronbach's alpha
Entrepreneurial ecosystem	Human capital	3	0.750
	Business support services	14	0.829
	Finance	5	0.817
	Policies	7	0.827
	Market	8	0.751
	Culture	6	0.773
	Research and development/ innovation	9	0.602
Entrepreneurship development	Entrepreneurship development	11	0.928
Source(s): Prepared by the researcher			

Ecosystem for entrepreneurship development

Variables	Mean	Standard deviation
Human capital	3.04	1.092
Business support services	2.59	1.069
Infrastructure	3.25	1.080
Finance	2.52	1.146
Policies	3.53	1.295
Market	2.44	1.087
Culture	2.54	1.015
R&D and innovation	1.50	0.337
Regularity	2.24	1.129

Note(s): All variables used a five-point scale (1 = No obstacle, 5 = severe obstacle) except research and development and innovation (yes/no)

Table 3. Descriptive analysis of entrepreneurial ecosystem
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Variables	Mean	Standard deviation	Table 4. Descriptive analysis of entrepreneurship development
Entrepreneurship development	2.8276	0.64404	
Note(s): All items used a-5 point scale with (1=highly decreased, 5 = highly increased)			

Table 5 presents the results obtained when entrepreneurial ecosystem was regressed on entrepreneurship development. The results indicate that, overall, the main hypothesis is partially supported.

$$ED = \beta_0 + 0.4\chi_1 + 0.3\chi_2 + 0.3\chi_3 + 0.2\chi_4 + 0.1\chi_5 - 0.2\chi_6 + \varepsilon \quad (2)$$

Where;

χ_1 is the human capital,

χ^2 is finance

χ_3 is government policies

χ_4 is infrastructure

χ_5 is R&D and innovation

χ_6 is regulatory framework

β_0 is the intercept and

ε is the random error.

5. Discussion

The results reveal that the regression model is significant ($F = 20.555$, $p < 0.001$). Six variables have significant effects on entrepreneurship development (Figure 2). The variables in unison explain approximately 66% of the total variation in entrepreneurship development and the remaining 34% is due to other factors, potentially macroeconomic conditions and entrepreneurial personal traits.

The results reveal that six of the study's hypotheses are supported, that is, there is a significant relationship between entrepreneurial ecosystem and entrepreneurship development. Human capital has the most significant effect on entrepreneurship

Table 5.
Multiple regression
result: the relationships
between
entrepreneurial
ecosystem and
entrepreneurship
development

Variables Model variables	DV: Entrepreneurship development Std. Beta	t
Government policy	0.298***	4.259
Business support services	-0.063	0.708
Finance	0.336***	4.845
R&D and innovation	0.151*	2.466
Regulatory framework	-0.178*	-2.374
Market	0.068	0.926
Human capital	0.409***	4.499
Culture	0.022	0.286
Infrastructure	0.167*	2.530
F value	20.555***	
Durbin-Watson	1.625	
R ²	0.658	
Adjusted R ²	0.626	
Note(s): Level of significance: * <i>p</i> < 0.10, ** <i>p</i> < 0.05, *** <i>p</i> < 0.01		

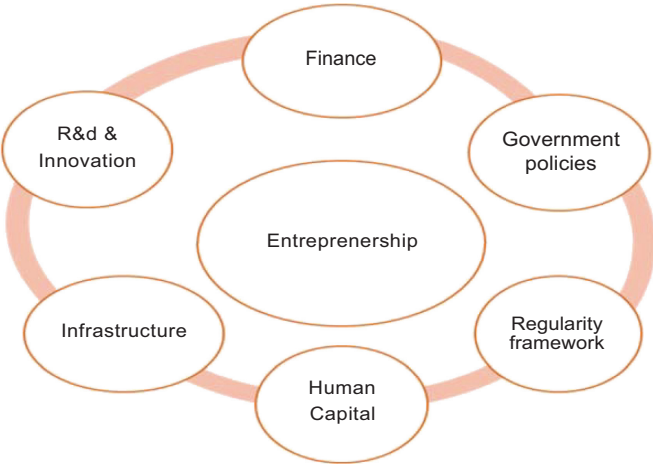


Figure 2.
Domains of the
entrepreneurial
ecosystem in the
manufacturing sector
of Sudan

Source(s): Prepared by researcher

development ($\beta = 0.409, p < 0.10$), followed by finance ($\beta = 0.336, p < 0.10$), government policy ($\beta = 0.298, p < 0.10$), regulatory framework ($\beta = 0.178, p < 0.05$), infrastructure ($\beta = 0.167, p < 0.05$) and research and development and innovation ($\beta = 0.151, p < 0.05$). Results additionally demonstrate that three of the study's hypotheses, namely: culture, market and support services are not supported. However, given the fact that infrastructure is part of hypothesis-backed support services, it is possible to say that support services are partially supported. The established significant influence of human capital on entrepreneurship development in Sudanese manufacturing firms is a positive one, according to this study's findings. This goes in line with the conclusions of Raposo and Paço (2011) and Gangi (2015), whose findings demonstrated that with more education and training, entrepreneurial endeavors can create growth and maintain sustainable development.

The logic behind this declaration is that education represents the main factor providing people with knowledge and skills that help them practice their jobs, besides specific

entrepreneurship training (Akhue monkhan *et al.*, 2013). Furthermore, according to Audretsch (2016); Acs *et al.* (2016); Kenny (2015) and Maritz *et al.* (2016), entrepreneurship education programs (EEPs) are regarded as integral and dynamic components of entrepreneurship ecosystems. Therefore, Sudanese manufacturing firms, possessing highly trained and skilled human capital, will achieve better entrepreneurship development. This result can be interpreted in light of the fact that the educational system's output and the labor market's technical requirements are rather mismatched. This incompatibility can be attributed to a shortage in technical education, which only represents 4% of general education at the primary level and 30% at the secondary level (ILO, 2014). As a result of this, firms depend on foreign labor whose entry procedures are complicated (Gorashi, 2010). In some sectors, such as mining, fluctuation in production is led by qualified and trained labor expatriation and high turnover for trained labor.

In addition to all the aforementioned, the country's poorly resourced labor force database, a likely ally for entrepreneurship in Sudan, is a major weakness in its entrepreneurship support system (Barro and Lee, 2013).

The study's conclusion in relation to finance is aligned with previous research expressing a significant relationship between finance and entrepreneurship development level (Beck and Demirguc-Kunt, 2006; Levie *et al.* (2014)).

One possible explanation for this outcome may be the difficulty of access to capital being a major constraint faced by entrepreneurs in emerging countries due to their risky nature (Panda and Dash, 2016). Therefore, finding ways to raise capital for entrepreneurs would represent a step toward entrepreneurship development.

Mason and Brown (2014) assure that businesses' inability to raise finance (on appropriate terms) is likely to limit the potential for entrepreneurial recycling. There are many indications that the manufacturing sector in Sudan faces financial problems. According to the Bank of Sudan's financing reports, the percentage of expenditure on financing the manufacturing sector is in decline.

Some banks are on the brink of collapse; being supported by the bank of Sudan through loans, capital and even participation in their management. This is an evident indication of weakness in the banking system. Some banks avoid financing certain sectors because of the high risk included in them. Moreover, the country is burdened with a high rate of inflation and a lack of hard currency. This situation hinders access to and inflates the cost of finance. Furthermore, the negative impact of American economic sanctions blockades the transfer of funds; majorly and negatively affecting external trade in the process.

This study also makes clear the importance of favorable government policy in encouraging the entrepreneurship development of Sudanese manufacturing firms. This coincides with the results of Levie *et al.* (2014), Berger and Kuckertz (2016) and Kasseeah (2016), who found a significant relationship between policy and entrepreneurship development. This relationship is obvious when misalignments occur between existing public policies in other domains and policies in place to encourage entrepreneurship development (Edoho, 2015).

In the Sudanese context, there are some policies that hinder the development of entrepreneurship. For example, regarding taxation, there is a distortion in the application of the value-added tax (duplication). Localities' fees are in the same boat, oftentimes collected without actual services rendered. Generally, laws affecting entrepreneurship take prolonged periods of time awaiting approval or changes (Gorashi, 2010). Therefore, reducing negative side effects of policies and increasing positive ones through government regulations is expected to lead to better entrepreneurship development in the Sudanese manufacturing sector.

Regarding business support services, the study reveals no significant relationships between them and entrepreneurship development. This contradicts the study of Khan (2014), (Aerts *et al.*, 2007), (Gately and Cunningham, 2014), which provided indication that a university's incubators and technology transfer mechanism resulted in an increase in

entrepreneurial activity. The empirical evidence proves more to this point, for example, (Sudanese Businessmen and Employers Federation Report, 2017) mentioned that government expenditure should be directed toward supporting production and gradually alleviating subsidies on luxurious consumer goods.

Overall, the hypotheses were partially supported because infrastructure, which gives significant relationship with the entrepreneurship development, is a part of supporting services. This, in addition to what is mentioned earlier is a nod to support services being linked with the entrepreneurship development.

Culture, deemed important in previous research where numerous studies have found support for its significant relationship with entrepreneurship development (Mazzarol (2014) and Brush (2014)), was found to have no effect on entrepreneurial development. Aaltonen (2016) states that national culture shapes potential entrepreneurs' tendency to create businesses and to innovate. Isenberg (2010) argues that culture and specifically, positive societal norms and attitudes toward entrepreneurship have been documented as key constituents of entrepreneurial ecosystems.

At a glance, there appears to be a tendency toward self-employment in the Sudanese environment due to a positive image of entrepreneurship and success stories, and there are many indications for this. For example, in Mashrouy project, the number of applications received since the start of the project in March 2013 is around 5,300 applications, in addition to increased numbers of applicants to the Graduate Employment National Fund (GENF), signing up to acquire training and funds for their own projects. Moreover, the microfinance policy, adopted by the Central Bank of Sudan, encourages private business. This indicates that the Sudanese culture, even though not in any substantially significant manner, encourages entrepreneurship development.

The study reveals a significant positive relationship between research and development and innovation, on one hand, and entrepreneurship development, on the other. Unsurprising, considering research, development and innovation are deemed essential sources of business success and economic development (Ding and Abetti, 2003).

According to industry conference (2010), there is a feeble link between research centers and the manufacturing sector in Sudan; and research does not match industry requirements. For example, the drugs manufacturing sector suffered weak expenditure on research and development, which require preparation of a suitable and encouraging environment, as well as incentives. Moreover, in the engineering sector, in general, and in construction materials in particular, there is a weak connection to research centers, leading to lower efficiency.

Entrepreneurship is either propelled or inhibited by regulatory framework of its operational context. In this study, a significant negative relationship between the regulatory framework and entrepreneurship development is apparent. It is deemed negative for the reverse nature of the relationship between regulatory bodies and entrepreneurship development in the Sudanese manufacturing sector. One explanation for this is that the main regulatory body, which is Sudanese Standards Metrology Organization (SSMO), is entrusted with ensuring compliance with standards both at the level of raw materials and inputs and at final products' level. Also SSMO has no accredited laboratories for Gum Arabic and mines (ISO 17025 laboratories), in addition to an absence of representation of exporters in the committee of standards' formulation (Industry Conference, 2010).

Similar to the context of a regulatory framework, infrastructure exerts a form of control on the potential for entrepreneurship development. There appears to be a positive relationship between infrastructure and entrepreneurship development as concluded in this study. Mazzarol (2014) states that "Entrepreneurial actors" need to be facilitated where possible via soft and hard infrastructure. Business incubators offer infrastructures at an inexpensive cost, such as office space, and allow sharing resources, which enhance entrepreneurship development (Carvalho and Galina, 2015). In the Sudanese context and regarding the

transportation sector, there are some problems; first: the decision of stopping (trucks) leads to a reduction of 60% in transportation power, followed by an increase in transporting cost of the (*Ton*) by 120%. This slowed the cycle of trucks, decreasing the number of containers, leaving lots of goods stranded at the seaports and prolonging shipment and unloading times (Industry Conference, 2010). There are also problems related to the supply of water used in production processes and power and electricity for the manufacturing sector. Sudan's infrastructure is not supportive for the development of entrepreneurship.

Logically, markets are the incentive for the initiation of business and would therefore be thought of as a driving force behind the development of entrepreneurship. Unexpectedly, the study's results show no significant relationship between markets and entrepreneurship development in the Sudanese manufacturing sector. However, research on entrepreneurship has indicated a positive relationship between entrepreneurial developments and the role of markets in driving this process. Although people across Africa have a great deal of economic strength, most of the time they fail to turn this strength into market opportunities (Abubakar, 2015). Moreover, access to markets, both domestic and foreign, plays a significant role in driving entrepreneurial activities according to (Kshetri, 2014). In the Sudanese context, the government does not establish a conducive environment for competition because government companies work in the private sector, where they enjoy exemptions from taxation and customs (Gorashi, 2010). This indicated that there is no equal treatment or free competition between government companies and the private companies. Even though empirical evidence gives the indication of a significant relationship between the markets and entrepreneurship development, the study results show no significant relationship, which merits further investigation. The logic behind this conclusion may be related to another reason, for example, the view of the market itself; generally speaking, in Sudan there is a limited view of the market, most companies depend on specific dealers to distribute their products and in turn they do not face market problems.

6. Conclusions, limitations and directions for future research

The study concludes that the relationship between the entrepreneurial ecosystem and entrepreneurship development was found to be significant when it comes to six factors, namely: finance, government policy, human capital, infrastructure, research and development and innovation and regulatory framework, whereas it was insignificant with relation to three factors, namely; culture, market and support services. Based on the findings of this study, it can be said that entrepreneurship in Sudan is a challenging issue, which will not be tackled unless policymakers in concerned bodies in the country give due consideration to the entrepreneurial ecosystem.

While this study contributes to increased understanding of the applicability of institutional theory through testing the relationships between entrepreneurial ecosystem and entrepreneurship development, the results obtained must be interpreted with caution as a consequence of certain limitations. First, the cross-sectional nature of the study entails that its conclusions be limited to relevant parties. Second, based on the multiple regressions analysis results, it may be seen that entrepreneurial ecosystem, as an analogy, can be used to explain entrepreneurship development among Sudanese manufacturing firms. The results of the regression analysis (R^2 -values) suggest that a moderate percentage of this variation is still unexplained. As discussed, this may be a function of macroeconomic conditions or personal traits of entrepreneurs or is perhaps a function of the multi-industry sample. This study represents an early attempt to build and test a theoretical framework of an entrepreneurial ecosystem. However, based on the limitations of the study examined earlier, it provides some suggestions for future research. These suggestions are as follows: first, although it could be costly and time-consuming, a longitudinal study is better suited for a clearer understanding of the dynamic, interactive and reversible nature of the relationship between entrepreneurial

ecosystem and entrepreneurship development. Moreover, this study fully relies on using a single-informant approach. Thus, future studies may be replicated using interviews with policymakers in addition to the standard questionnaire. Second, the insignificant relationships revealed between some entrepreneurial ecosystem factors and entrepreneurship development may also be due to the nature of particular companies' profiles or the personal traits of entrepreneurs. As such, future studies are recommended to examine the possible effects of company profiles and the personal traits of entrepreneurs on the association between the entrepreneurial ecosystem and entrepreneurship development.

7. Recommendations

In the light of the literature, findings, discussions and conclusions, the study recommends that a more effective policy for enhancing entrepreneurial ecosystems should be formulated in a holistic manner, in addition to the establishment of a coherent regulatory framework to coordinate planned interventions by the diverse bodies concerned. In particular, the study recommends upgrading the quality of infrastructure and services for the manufacturing sector as well as allocating funds to support the sector. Finally, a body of knowledge pertinent to the entrepreneurial ecosystem is needed, with connections established to academic networks at universities and relevant research centers. It is also deemed necessary for entrepreneurs to work toward building and keeping a healthy entrepreneurial ecosystem.

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Further reading

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Appendix

Table A1.
Rotated factor loading
for entrepreneurial
ecosystem

Items	Component								
	1	2	3	4	5	6	7	8	9
<i>Factor 1: Finance</i>									
22. Access to joint venture	0.820	-0.115	0.031	0.284	0.027	0.017	0.101	-0.048	-0.042
21. Foreign direct investment	0.796	0.002	0.078	0.058	0.012	0.276	-0.180	0.029	0.108
18. Access to credit	0.722	0.098	0.125	-0.040	0.084	0.019	0.330	0.185	0.089
20. Government subsidies	0.627	0.158	0.006	-0.024	0.073	0.485	0.071	0.058	0.126
19. Access to equity finance	0.584	0.188	0.088	0.209	0.053	-0.156	0.376	0.280	-0.069
<i>Factor 2: Infrastructure</i>									
14. Water	0.042	0.834	0.093	-0.018	-0.001	0.047	0.074	0.050	0.004
13. Telecom	-0.006	0.783	-0.034	0.122	-0.037	-0.001	0.019	0.096	0.057
12. Electricity	0.054	0.687	0.126	0.159	0.062	0.272	0.037	0.017	0.277
16. Transport	0.057	0.684	0.186	0.065	-0.023	-0.091	0.167	0.141	-0.173
<i>Factor 3: Market</i>									
31. Access to local market	-0.039	0.027	0.806	0.064	0.082	-0.040	0.158	0.049	0.130
30. Market entry barriers	-0.033	0.126	0.715	0.216	-0.101	0.158	-0.004	0.146	0.124
34. Import products competition	0.196	0.201	0.684	0.064	0.063	0.070	0.119	-0.019	0.001
33. Availability of information	0.143	-0.009	0.607	0.269	0.000	0.146	0.193	0.050	0.051
<i>Factor 4: Culture</i>									
36. Bargaining power of suppliers	0.119	0.089	0.120	0.747	-0.053	-0.035	0.099	0.235	0.118
37. Bargaining power of buyers	0.121	0.132	0.140	0.727	-0.132	-0.078	0.350	-0.109	0.083
41. Cultural and social norms	0.173	0.127	0.258	0.626	-0.017	-0.057	0.029	0.354	0.132
42. entrepreneurship awareness	0.020	0.059	0.244	0.597	0.107	0.339	0.010	0.194	0.094
<i>Factor 5: Research and development and innovation</i>									
51. Annual budget for R&D	0.003	0.070	0.107	0.059	0.811	0.101	-0.084	-0.042	-0.047
50. R&D collaboration	0.140	-0.119	-0.145	-0.014	0.749	0.066	0.157	-0.047	-0.065
52. Built-in R&D department	0.017	0.127	-0.031	-0.038	0.717	0.113	-0.071	-0.037	0.220
46. Trademark	0.055	-0.233	0.244	-0.174	0.606	-0.144	0.061	0.308	-0.109

(continued)

Items	1	2	3	4	Component 5	6	7	8	9
<i>Factor 6: Policies</i>									
26. Tax authorities	0.092	0.040	0.129	0.052	0.168	0.791	0.196	0.105	-0.001
27. Localities authority	0.153	0.050	0.105	-0.032	0.036	0.783	0.168	0.148	0.021
<i>Factor 7: Regularity framework</i>									
28. Standardization	0.046	0.058	0.307	0.152	-0.025	0.239	0.741	-0.034	0.051
29. Consumer protection	0.133	0.049	0.262	0.193	0.073	0.202	0.699	-0.087	0.091
4. Access to legal services	0.184	0.292	0.041	0.045	-0.039	0.133	0.627	0.266	0.257
<i>Factor 8: Human capital</i>									
38. Entrepreneurship motivation	0.203	0.003	0.011	0.060	-0.058	0.360	0.133	0.713	-0.030
39. Risk avoidance	0.104	0.123	0.063	0.349	0.052	0.051	-0.065	0.691	0.158
1. Lack of qualified managers	-0.054	0.384	0.140	0.182	-0.009	0.074	-0.012	0.655	0.199
<i>Factor 9: Support Services</i>									
8. Network development	0.040	0.072	0.068	0.341	0.028	0.040	0.107	0.061	0.762
10. Mentorship	0.210	0.007	0.246	0.023	0.004	0.008	0.159	0.184	0.752
Eigenvalues	7.05	2.82	2.16	2.10	1.79	1.56	1.30	1.13	1.08
Percentage of variance explained	22.7	9.1	7.0	6.8	5.8	5.0	4.2	3.6	3.5
Total variance explained (%)						67.7%			
Kaiser-Meyer-Olkin (KMO)						0.719			
Bartlett's test of sphericity						1390.84*			
Note(s): $N = 106$, $*p < 0.05$									

Table A1.

Table A2.
Rotated factor loading
for entrepreneurship
development

Items	1	Component 2	3
<i>Factor 1</i>			
9. Rate of innovation in means (past three years)	0.849	0.019	0.041
11. Gross profit	0.844	0.091	0.073
4. Sales volume	0.716	−0.056	0.126
<i>Factor 2: Entrepreneur growth</i>			
2. Employment	0.049	0.746	−0.097
3. Number of products	0.063	0.732	0.214
5. Rate of innovation in products (in the past three years)	−0.186	0.705	−0.029
6. Rate of innovation in processes and methods (in the past three years)	0.063	0.562	−0.118
7. Net profit	0.470	0.551	0.083
<i>Factor 3: Business expansion</i>			
10. Rate of new employment (past three years)	0.085	0.031	0.859
1. Business expansion	0.003	−0.014	0.779
8. Number of new product lines	0.162	−0.059	0.705
Eigenvalues	2.686	2.125	1.603
Percentage of variance explained	24.418	19.316	14.576
Total variance explained (%)	58.309		
Kaiser–Meyer–Olkin (KMO)	0.606		
Bartlett’s test of sphericity	297.286*		
Note(s): $N = 106$, $*p < 0.05$			
Source(s): Prepared by the researcher			