



# Entrepreneurial Ecosystem Diagnostic Toolkit

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Development Entrepreneurs

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# Introduction

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The past decade has seen a significant reduction in conflict, improved political and macroeconomic stability, a number of economic reforms, and considerable economic growth across countries in emerging markets.

However, the wages and livelihoods of many developing country citizens have not kept up, and lag behind the rest of the world. Entrepreneurship has the potential to address this gap, if it is able to evolve beyond the informal, necessity-based entrepreneurship that is currently prevalent in many emerging economies. Opportunity-based firm creation led by managers that intend to grow their businesses can generate increased employment and sustainable income for the poor.<sup>1</sup> Development finance institutions can play an important role in enabling entrepreneurship in emerging markets.

A first step to stimulating entrepreneurship is mapping and measuring the existing entrepreneurial ecosystem. This analysis allows for diagnosis of potential challenges and opportunities that can be addressed through specific interventions. To support mapping efforts, this toolkit has been developed by the Aspen Network of Development Entrepreneurs (ANDE), with the support of the UK Department for International Development (DFID). It provides methodological guidance on assessing the current state of entrepreneurial ecosystems and offers a set of resources and tools that can be used by development practitioners. This toolkit does not aim to be exhaustive, but is intended to serve as a basis for other organizations to build upon.

To develop this toolkit, ANDE conducted a comprehensive review of publicly available literature on entrepreneurial ecosystems and identified nine evaluative frameworks. We assessed these frameworks and synthesized key elements and indicators. ANDE encourages practitioners to use this toolkit as a resource guide that can be adapted and modified to fit the local and/sectoral context.

# Studying the Entrepreneurial Ecosystem

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The process of developing an enabling ecosystem for entrepreneurship has received considerable attention from governments, development agencies, and academics. Organizations like the Council on Competitiveness (CoC) in the United States, the GSM Association, the Organisation for Economic Co-operation and Development (OECD), the World Bank, and the World Economic Forum have developed comprehensive diagnostic tools for assessing and tracking the development of the ecosystem. Additionally, there have been similar evaluative frameworks developed by successful venture capitalists, development consultants, and universities. ANDE reviewed nine separate approaches as part of this synthesis:

1. **Babson College** - Babson Entrepreneurship Ecosystem Project
2. **Council on Competitiveness** - Asset Mapping Roadmap
3. **George Mason University** - Global Entrepreneurship and Development Index
4. **Hwang, V.H.** - Innovation Rainforest Blueprint
5. **Koltai and Company** - Six + Six
6. **GSM Association** - Information and Communication Technology Entrepreneurship
7. **Organisation Economic Co-operation and Development** - Entrepreneurship Measurement Framework
8. **World Bank** - Doing Business
9. **World Economic Forum** - Entrepreneurship Ecosystem

These approaches vary widely, and can be classified based on the geographic unit of analysis, their level of detail, and their sectoral or domain focus. For example, some approaches, such as the *OECD's Entrepreneurship Measurement Framework*, the *World Bank's Doing Business* ranking, and *George Mason University's Global Entrepreneurship and Development Index*, are national level assessment frameworks, that can be used to make cross-country comparisons. In contrast, the *Council on Competitiveness' Asset Mapping Roadmap* and the *Innovation Rainforest Blueprint* are specifically aimed at local ecosystems. Some frameworks such as the *Babson Entrepreneurship Ecosystem Project* and the *Koltai Six+Six* may be used at a national or sub-national level.

The Asset Mapping Roadmap is the most comprehensive and detailed framework in our review, with over 150 individual indicators, across eight domains. The OECD framework is also extensive, listing 57 key indicators to measure the determinants of entrepreneurship in a country, framed across six domains. Other approaches, such as the Babson model, and the Koltai framework, are more conceptual, and do not prescribe a common set of indicators, but focus on key domains (e.g., policy, finance, culture), and specific actors (e.g., banks, incubators, venture capital). These frameworks can be implemented based on available data sources, and allow for more flexibility in assessing the entrepreneurial ecosystem. It should also be noted that not all of these frameworks are in the public domain, and some may have additional proprietary characteristics that are not covered in this synthesis. We also recognize the complexities associated with assessing entrepreneurial ecosystems, and that many of the frameworks reviewed have not been previously tested in a developing country.

Finally, some of the frameworks reviewed focused on a limited number of domains, or sectors. For example, the World Bank's Doing Business framework specifically focuses on policy and the

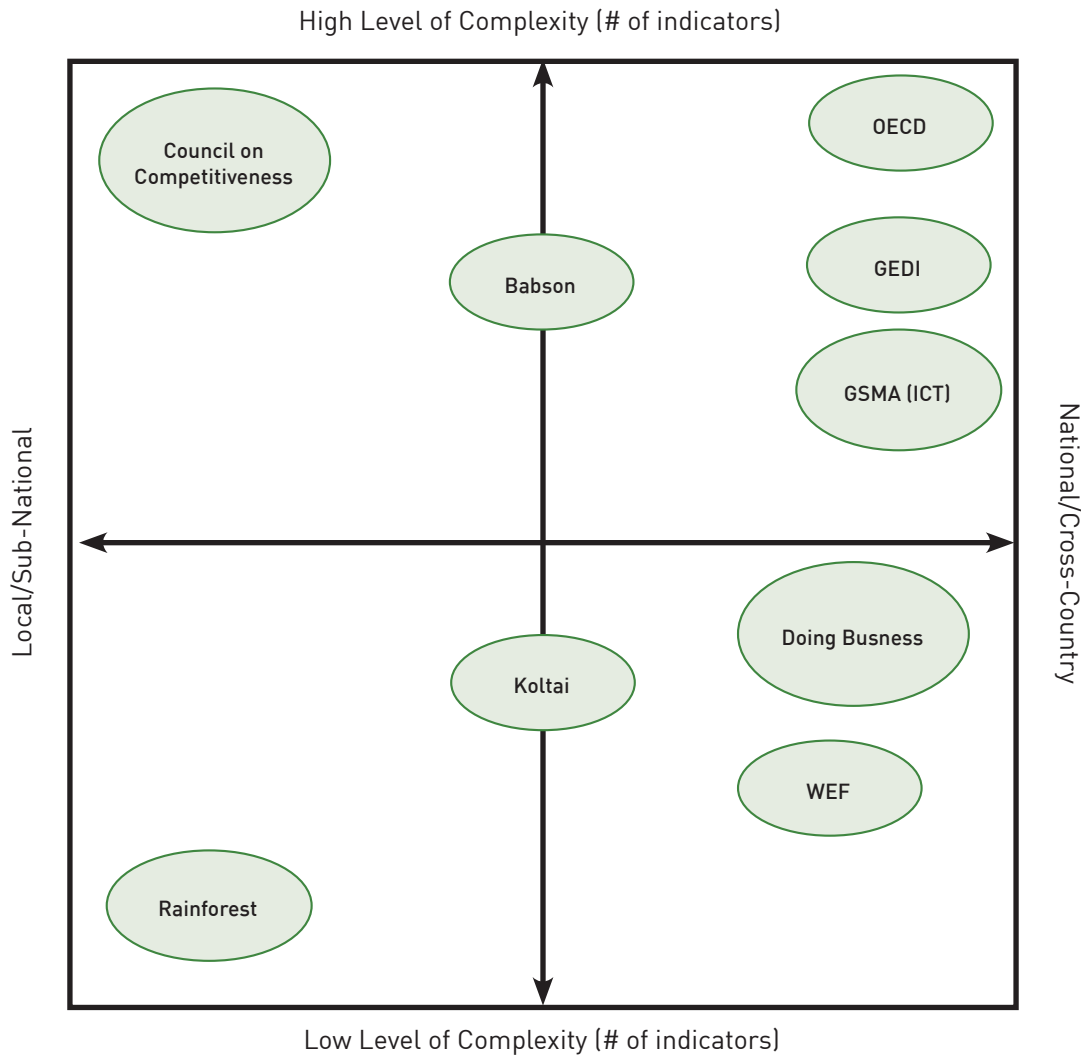
enabling environment, the Rainforest Blueprint focuses on developing an entrepreneurial culture, and the GSM Association’s approach is targeted at the information and communication technology sector (ICT). A summary of the various domains and the extent to which they are discussed in each framework is presented in Table I.

**Table I: A Review of Entrepreneurial Ecosystem Diagnostic Tools**

Domain	Babson	CoC	GEDI	Rainforest	6+6	GSMA (ICT)	OECD	Doing Business	WEF
Policy	✓	✓	✓		✓	✓	✓	✓	✓
Finance	✓	✓	✓	✓		✓	✓		✓
Infrastructure	✓	✓				✓	✓	✓	✓
Markets	✓		✓			✓	✓		
Human Capital	✓	✓	✓	✓	✓	✓	✓		✓
Support / Services / Connections	✓	✓	✓		✓	✓	✓		✓
Culture	✓	✓	✓	✓	✓	✓	✓		✓
R&D / Innovation	✓	✓	✓	✓		✓	✓		
Quality of Life		✓							
Macroeconomic Conditions							✓		

Nine approaches were evaluated categorized based on two criteria: Geographic Unit of Analysis and Complexity (indicated by the number and type of prescribed indicators). Figure I provides a mapping of these nine approaches, based on their geographic unit of analysis (horizontal axis), and the level of detail, based on the number and extent of the prescribed indicators (vertical axis). The domains *Quality of Life and Macroeconomic Conditions* each occur in only one of these approaches. As mentioned previously, the Council on Competitiveness and the OECD are the most detailed, and focus on the local and national levels, respectively.

**Figure I: Comparing Entrepreneurial Ecosystem Assessment Frameworks**



Much of the research on entrepreneurial ecosystems in developed and developing countries emphasizes the need to take a multi-dimensional approach to measurement, taking into account all the various domains that can affect entrepreneurship in a region, and how they interact with each other. Since two of the measurement frameworks in our review are primarily focused on a limited number of domains (*Doing Business* primarily measures policy, and to some extent, infrastructure; the *Rainforest* framework largely focuses on entrepreneurial culture and human capital), our analysis focuses on the remaining seven approaches. Complete summaries of each of these approaches are provided in Appendix I.

1. **Babson College** - Babson Entrepreneurship Ecosystem Project
2. **Council on Competitiveness** - Asset Mapping Roadmap
3. **George Mason University** - Global Entrepreneurship and Development Index -
4. **Koltai and Company** - Six + Six
5. **GSM Association** - Information and Communication Technology Entrepreneurship
6. **Organisation Economic Co-operation and Development** - Entrepreneurship Measurement Framework
7. **World Economic Forum** - Entrepreneurship Ecosystem

# A Synthesis of Existing Frameworks

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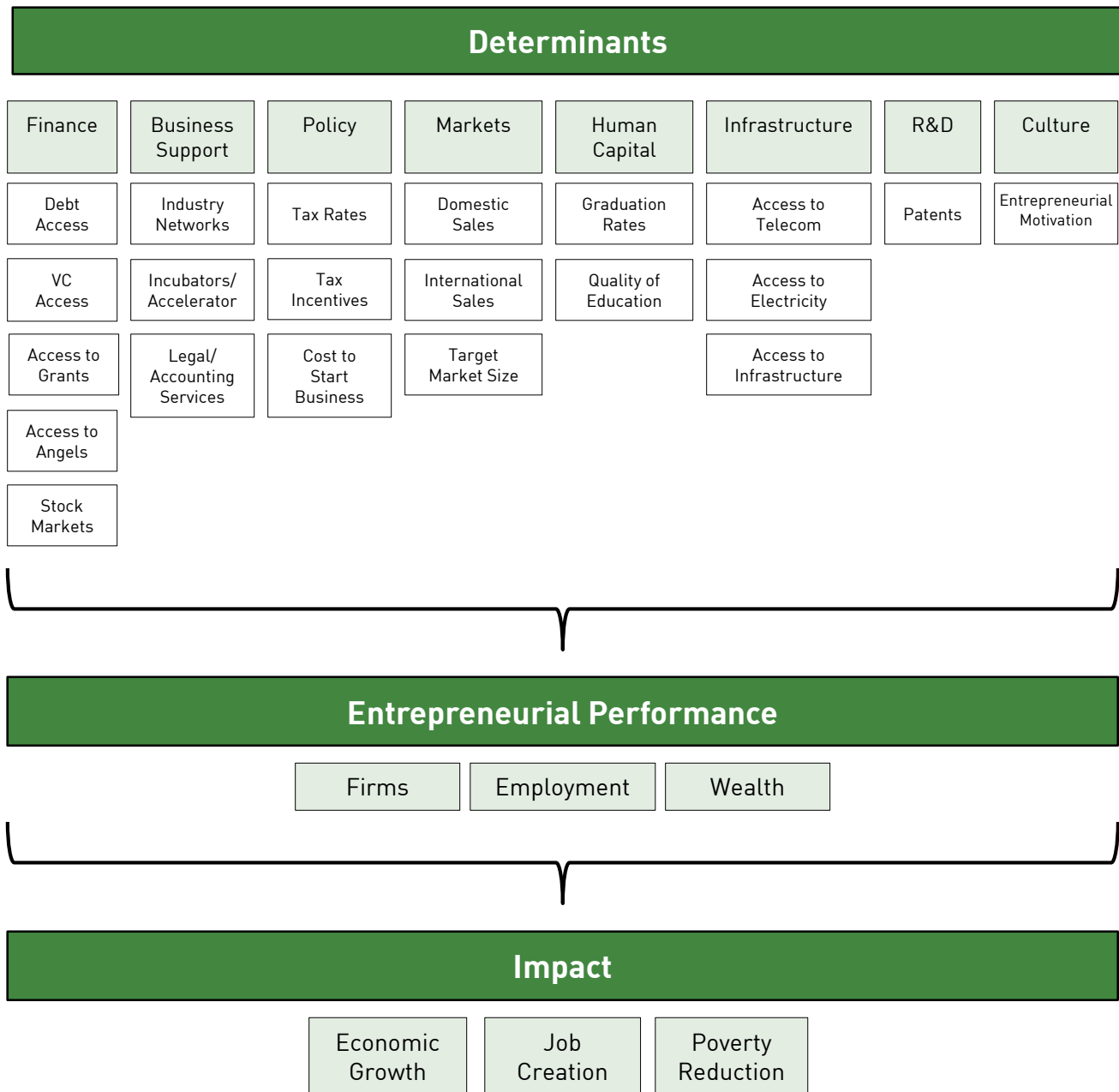
Entrepreneurship is often considered a means to specific socio-economic development goals, which suggests that there is a need to measure the level of entrepreneurship, the factors that determine these levels, and ultimately, the impact of the entrepreneurial activity. This perspective is reflected in the OECD's Entrepreneurship Measurement Framework, which was supported by the Kauffman Foundation. The OECD's Statistics Directorate developed the Entrepreneurship Indicators Programme, which explicitly recognizes the role that entrepreneurship can play in addressing specific issues such as economic growth, job creation, or poverty reduction.<sup>2</sup> The framework identifies three broad elements that are important in assessing the entrepreneurial ecosystem: *determinants*, *entrepreneurial performance*, and *impact*. These three elements make sense as a starting point for ecosystem assessment.

While there are a limited number of indicators for measuring impact and entrepreneurial performance, the number of potential determinants is fairly extensive. Finally, some of these impacts, and aspects of entrepreneurial performance, may also feed back into the determinants - for example, economic growth may boost access to finance for small firms.<sup>3</sup> Figure II illustrates how these elements align, and provides examples of potential indicators.

## Elements of Assessing Entrepreneurial Ecosystems

1. ***Entrepreneurship determinants*** refers to the various factors that affect entrepreneurship, which is the primary focus of the seven ecosystem mapping tools reviewed in this paper. Despite the varied sources for these evaluative approaches, they are relatively consistent in terms of broad themes and actors that would be considered determinants of entrepreneurship, such as specific policies, amount of venture capital financing deployed, and the availability of business development services.
2. ***Entrepreneurial performance*** refers to the specific activities that entrepreneurs perform that will ultimately deliver the impacts. Indicators such as the total number of formal businesses in an economy, the number of high-growth firms (gazelles), employment figures, and enterprise survival and death rates are all considered measures of entrepreneurial performance.
3. ***Impact*** refers to the *value* created by entrepreneurs, and entrepreneurship, which may be measured in terms of macroeconomic variables, such as GDP growth, employment, Gini coefficients (to measure income distributions), or the size of the formal sector vs. the informal sector. The authors of the OECD framework note that most of these indicators are used extensively for economic research, and are comparable across countries.

Figure II: Entrepreneurship Measurement Framework



Source: Adapted from OECD Eurostat

ANDE suggests that a comprehensive evaluative framework for entrepreneurial ecosystems should focus on the following eight domains, and the key actors associated with each area (Table II). This analysis focuses on domains that recur in at least two of the frameworks reviewed, thus excluding *Quality of Life* and *Macroeconomic Conditions* from our synthesis. However, it should be noted that not all of these domains will affect the growth of entrepreneurship directly. We suggest that these domains can be placed on a spectrum, ranging from a *direct* influence (through finance, business development services), *partially direct* influence (through policy, markets, human capital), and *indirect* influence (culture). While these are not rigid classifications, this classification can help development agencies to prioritize domains based on their mandate and capabilities, and better understand the extent to which entrepreneurial growth can be attributed to a program in a specific domain.



**Table II: Entrepreneurial Ecosystem - Domains for Analysis**

Direct		Partially Direct					Indirect
Finance	Support	Policy	Markets	Human Capital	Infrastructure	Research & Development	Culture
Banks	Incubators	National Government	Domestic Corporations	Universities	Electricity providers	Public Research Centers and Laboratories	Media
Venture Capital	Accelerators	State Government	International Corporations	Technical Training Institutes	Transport providers	Private Research Centers and Laboratories	Government
Angel Investors	Industry Associations / Networks	Local Government	Consumers	High Schools	Communications (Mobile, internet)		Schools
Foundations	Legal services		Distribution Networks	Community Colleges	Other utility providers (gas, water)		Professional Associations
Microfinance Institutions	Accounting Services		Retail Networks				Social Organizations
Public Capital Markets	Technical Experts / Mentors		Marketing Networks				
Development Finance Institutions	Credit Rating Agencies						
Government							

The effects of some policies or investments in infrastructure are possible to measure, when they are directly targeted at enterprises (e.g., providing reliable electricity to an industrial cluster). However, these effects may be indirect or diffused in some cases, and more difficult to measure when they have several objectives. For example, an investment in road infrastructure can generate several benefits, in addition to its effects on entrepreneurship in the region. While some domains such as culture may be important determinants of entrepreneurial activity in the region, interventions in these cases are relatively difficult to evaluate. Finally, it is important to

examine how various domains interact with each other, which is likely to vary depending on the specific local context. Understanding these interactions is critical to assessing the entrepreneurial ecosystem, and designing appropriate interventions.

In addition to identifying the key domains for analysis, we reviewed over 200 indicators of entrepreneurial determinants, performance and impact from the seven evaluative frameworks, and identified the most relevant indicators for conducting ecosystem analyses in developing countries. A comprehensive list of 65 indicators across these domains is provided in Appendix II.

It is important to recognize that not all of these indicators will be applicable in every context. We provide guidance on selecting the most relevant indicators based on the relevance, availability, and quality of data.

The firm level survey instrument provided in Appendix III is designed to provide a holistic assessment of the ecosystem from the perspective of the firm. The survey combines entrepreneurial perceptions of the business environment with objective measures of firm performance and open-ended questions which enable a nuanced understanding of local firm capacity and needs.

The survey may also be combined with sector-relevant questions as needed. A significant number of questions used in the World Bank's Enterprise Surveys<sup>5</sup> have been included, which will allow comparison of the local ecosystem to an established database of firm-level information from that country. In order to be most accurate and actionable, ANDE recommends conducting the survey at a local or metropolitan region level, though it may also be used on a larger scale. To be most effective, it is essential to identify comparable regions or benchmarks against which the region of interest is compared.

Finally, there is a large number of existing data sources that can provide valuable input in assessing entrepreneurial ecosystems. We reviewed 25 datasets on entrepreneurship, the entrepreneurial climate, and workforce which collectively can support a deep assessment of the policy and enabling environment as well as firm-level performance. Overall, fifteen global (cross-country) datasets and ten country-level datasets from Africa on firms and households (from Ghana, Tanzania, Kenya, Morocco, Ethiopia, and South Africa) were identified. Appendix IV provides a summary of the datasets, in terms of the unit of analysis, type of data, availability, and sampling methodology.

The World Bank's Enterprise Surveys are the most comprehensive, and wide-ranging datasets available, with information on over 130,000 firms from 135 countries. Key data points include firm characteristics, sales, finances, R&D, entrepreneur/top manager, government relations, quality of infrastructure, competition and workforce, employee characteristics, impact on communities, and entrepreneurial motivation/culture. Other country-level datasets also provide considerable detail on firm characteristics and activity, but the Enterprise Surveys offer the opportunity to draw effective cross-country comparisons due to the consistent methodology.

## Guidelines for Conducting an Assessment of an Entrepreneurial Ecosystem

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1. *Geographic Unit of Analysis:* As a first step, it is essential to identify the geographic region for study, which may be a metropolitan region, a state or province, or the entire country. A number of the frameworks reviewed focus on measuring entrepreneurial indicators at the national level. However, the economic diversity of most countries makes national assessments less actionable. Instead, assessments of specific regions within a country (e.g. a metropolitan area) and specific sectors (eg, tourism), are likely to be a more effective approach to guide program development and specific interventions. Based on the geography and sector focus selected, evaluators should also select comparable regions or standardized benchmarks, to draw meaningful comparisons.

2. *Depth of Analysis:* Project scoping should also include the level of analysis that is needed to provide actionable recommendations to the relevant stakeholders. The Council on Competitiveness suggests 3 levels of analytical depth:
  - **Asset Identification:** Reviewing existing research and data sources, and obtaining input from local leaders of key public, private, academic and nonprofit entities.
  - **Basic Evaluation:** Assessing the strengths and weaknesses of the ecosystem, and identifying gaps, with comparisons to relevant benchmarks or comparable regions.
  - **Comprehensive Assessment:** A complete examination of the underlying business culture in the region, including understanding the linkages between the various domains and key actors within each domain.
3. *Domains of Interest:* While the ecosystem is inherently interconnected, there may be some elements that are of more interest than others, based on the kinds of interventions that are planned and/or possible. For example, international development agencies may have less influence over local infrastructure and media than other domains.
4. *Identifying and Rating Indicators:* Despite the wide range of indicators available for entrepreneurship research, it is essential to identify the most relevant and accurate indicators available. Hoffman (2006), the OECD (2004), and Wallman et al, (2004), provide guidance on assessing the quality of indicators within a framework.

The OECD has developed a framework to assess the quality of indicators, based on 3 dimensions: relevance, accuracy, and availability.

*Relevance:* A qualitative assessment of the value contributed by the indicator, based on how closely it measures the framework condition it is supposed to measure, and whether the proposed intervention will have a direct or indirect impact on the indicator. For example, the *time and cost to start a business* may be considered a close measure of *barriers to formalization*.<sup>6</sup>

*Accuracy:* The degree to which the indicator correctly estimates or describes the characteristics it is designed to measure. The data collection method and the degree of standardization (across units of analysis) will affect the accuracy of an indicator. Typical sources of data collection error include sampling, non-response, and processing errors. The level of accuracy of an indicator can also be gauged by whether it is considered a verifiable *fact*, an *action*, or a *perception*. For example, some of the indicators described (such as interest rates, number of patents, and tax rates) are factual, and can be verified by appropriate data sources. Other actions, such as number of loans disbursed and number of networking activities can be tracked. However, a number of indicators (such as level of business satisfaction with infrastructure, are not as objective, but can provide valuable insight that verifiable indicators sometimes lack. Finally, the more standardized the indicator, the easier it is to enable accurate comparisons across units.

*Availability:* Availability is assessed across geography (i.e. is the indicator available across cities, states, countries), and across time (whether longitudinal data is available).

5. *Data Collection and Analysis:* A comprehensive assessment typically involves a combination of primary and secondary data collection. While it is likely that many of the indicators suggested in Appendix II will be available through local statistical and administrative agencies, some of the proposed indicators (such as business community satisfaction with existing infrastructure, human capital) will likely require additional surveys. Once the appropriate indicators have been identified, evaluators can identify the gaps in the ecosystem, and develop potential interventions.

# Conclusion

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This toolkit provides a synthesized set of resources for practitioners to assess the entrepreneurial ecosystem in developing countries. It is designed to be a starting point for entrepreneurial ecosystem assessment activities.

- We recommend conducting a holistic assessment of the various domains of the ecosystem, using a combination of primary data collection (through firm surveys and stakeholder interviews) and secondary sources (such as government records, industry associations and published academic research).
- We recommend identifying comparable regions or benchmarks to make the assessment more useful in tracking progress.
- Practitioners should adapt and modify the proposed methodology with input from local experts, and tailor it to the specific needs of their programs.

## List of Appendices

- Appendix I: Entrepreneurial Ecosystem Assessment Frameworks
- Appendix II: Indicators for Assessing the Entrepreneurial Ecosystem
- Appendix III: Firm Survey Instrument
- Appendix IV: Sources of Enterprise Data

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## Endnotes

<sup>1</sup> Omidyar Network and Monitor Group (2012). "Accelerating Entrepreneurship in Africa: Understanding Africa's Challenges to Creating Opportunity-driven Entrepreneurship." *Omidyar Network*

<sup>2</sup> Ahmad, N., & Hoffmann, A. (2008). A framework for addressing and measuring entrepreneurship. *Organisation for Economic Co-Operation and Development*

<sup>3</sup> Ibid.

<sup>4</sup> Innovations for Poverty Action (2013). IPA SME Initiative – Projects.

<sup>5</sup> The World Bank and the International Finance Corporation, "Enterprise Surveys: What Businesses Experience" <http://www.enterprisesurveys.org/>

<sup>6</sup> The World Bank. "Doing Business: Measuring Business Regulations". <http://www.doingbusiness.org/>

# Appendix I: Entrepreneurial Ecosystem Assessment Frameworks

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## **Babson College - The Babson Entrepreneurship Ecosystem Project (BEEP)** <http://entrepreneurial-revolution.com/>

The Babson Entrepreneurship Ecosystem Project stems from the observation that in all societies in which entrepreneurship occurs with any regularity or is self-sustaining, there is a unique and complex environment or ecosystem. The Babson Entrepreneurship Ecosystem finds that there are approximately a dozen elements that interact in complex ways. Thus in order to promote entrepreneurship, a holistic approach must be taken.

The BEEP categorizes their framework into six domains. *Policy* looks at both government regulations and support of entrepreneurship along with leadership. *Finance* looks at the full spectrum of financial services available to entrepreneurs. *Culture* accounts for both societal norms along with the presence of success stories to inspire the next generation of entrepreneurs. *Supports* examine physical infrastructure, non-governmental institutions and the presence of supporting professions such as lawyers, accountants and investment bankers. *Human Capital* examines both the quality of higher education system and the skill level of the work force. Finally, *Markets* look at both entrepreneurial networks and the presence of early customers.

## **Council on Competitiveness - Asset Mapping Roadmap**

<http://www.compete.org/publications/detail/33>

The Council on Competitiveness (CoC) takes a comprehensive asset mapping approach in order to evaluate the key assets that shape an economic ecosystem as well as the major gap areas that require further investment. It also aims to create a baseline against which

future progress can be measured. The Council recommends that eight major categories of assets should be examined. They are: *Human Capital, Research and Development Institutions, Financial Capital, Industrial Base, Connective Organizations, Legal and Regulatory Environment, Physical Infrastructure, and Quality of Life*. In addition to these categories of assets, the CoC framework takes into account *regional networks* -both the formal and informal linkages between these regional assets- that allow for collaborative economic development partnerships to take hold. Finally, the CoC also considers *culture* as a critical element that can either foster collaboration and innovation or prevent effective knowledge sharing.

The CoC asset mapping framework specifies the broad asset categories and provides a comprehensive list of indicators that can be used to measure a given region's assets in that particular category.

## **Global Entrepreneurship and Development Index - George Mason University**

<http://www.thegedi.org/>

The GEDI is based on an emerging theory of National Systems of Entrepreneurship. This extension of National Systems of Innovation theory focuses on the importance of various institutions in fostering entrepreneurship. While GEDI believes that the institutional framework is critical, it also examines individual and firm level data to better evaluate the quality of actors operating in this framework to better evaluate the entrepreneurial ecosystem. GEDI's institutional analysis is a super index of other institutional indices. For example, *corruption* is measured by Transparency International's Corruption Perception Index and *economic freedom* by the Heritage/ World Banks doing business study.

GEDI also collects novel data on individuals and firms through their own survey based mechanism. This survey measures socio-cultural factors such as risk tolerance, status perception of entrepreneurship and gender equity, along with quality of firm indicators such as education level of managers, and technology adoption in new firms. The GEDI then uses a complex method to weight these indices. First individual level indicators are combined with associated institutional variables to form one of 15 “pillars.” For example the “*start-up skills*” pillar is measured by weighting *tertiary education*, an institutional variable, with *skills perception* an individual level metric that captures the percentage of the working age population that claims to possess the skills needed to start up a business. The 15 pillars are: *opportunity perception, startup skills, non-fear of failure, networking, cultural support, opportunity startup, technology sector, quality of human resources, competition, product innovation, process innovation, high growth, internationalization, and risk capital*. These pillars are then aggregated into three sub-indices that measure; *entrepreneurial ability, entrepreneurial attitudes* and *entrepreneurial aspirations*. This aggregation is done through a novel method referred to as the “bottleneck penalty method” which penalizes all of the pillars based on the lowest performing pillar.

### **GSM Association - Mobile for Development Network**

<http://www.gsma.com/mobilefordevelopment/>

The GSMA framework focuses primarily on ICT innovation and the ecosystem of support that can attract investment and drive long term economic development in the sector. The GSMA framework targets several stakeholder groups which it believes influence the ecosystem of ICT entrepreneurship. These are: *entrepreneurs, investors, support organizations, research centers, mobile operators, and governments*. These stakeholder groups will be analyzed through a variety of research methods including

surveys, interviews and focus groups in order to inform the following research themes: socio-economic context and outlook, *ICT and mobile industry context and outlook, commercial, technical and financial barriers to growth, and longer term sustainability of ICT and mobile industry*.

### **Koltai and Company LLC - Six + Six Model**

<http://www.stevenkoltai.com/about-us>

The Koltai and Company (KolCo) Six + Six model is designed to help quantitatively and qualitatively identify the strengths and weaknesses of an entrepreneurial ecosystem. This analysis looks at six “pillars” or activities that support an entrepreneurial ecosystem, as well as six participants that traditionally conduct these activities.

KolCo seeks to examine how entrepreneurs are: *identified, trained, connected* to networks, *funded*, enabled by *regulatory frameworks*, and *celebrated* in society. Kolco also looks at the participants responsible for facilitating those activities. The participants of focus are: *NGOs, foundations, academic institutions, investors, governments, and corporations*. While Kolco does not publicly provide any specific indices, it utilizes a combination of existing indices and field work to inform its Six + Six framework.

### **Organisation for Economic Co-operation and Development (OECD) - Entrepreneurship Measurement Framework**

<http://www.oecd.org/industry/business-stats/>

The OECD framework seeks to inform policy makers and help to create a sound base for internationally comparable indicators of entrepreneurship. This framework examines the factors that motivate or impede entrepreneurship (*determinants*) and also provides indicators about the current state of entrepreneurship (*entrepreneurial performance*), and the outcomes (*impact*) of entrepreneurship on the economy as a whole. Importantly the OECD uses

a unique definition of entrepreneurship that defines entrepreneurial activities as the pursuit of the generation of value through the creation or expansion of economic activity, by identifying and exploiting new products, processes or markets. This definition then does not limit entrepreneurship to new firms or small business and allows for large firms to be entrepreneurial.

The OECD conceptualizes the ecosystem of entrepreneurship as the combination of three factors: *opportunities, skilled people and resources*. These three factors are influenced by two important themes: culture and regulatory framework. These factors and themes can be simplified into six key determinants: regulatory framework, market conditions, access to finance, R&D and technology, entrepreneurial capabilities and culture. The OECD Framework also specifies the variety of indicators that can be used to gauge each of these determinants.

## World Economic Forum - The Entrepreneurship Ecosystem

<http://www.weforum.org/>

The World Economic Forum (WEF) looks at both the prevalence of initiatives to support entrepreneurship such as incubation programs, along with the ecosystem that supports entrepreneurship. The WEF believes that entrepreneurs rely on four layers of support and that the combination of these four types of “enablers” allows entrepreneurs to succeed. These enablers are: *Personal Enablers* such as mentors and education, *financial enablers* such as banks investors and microfinance, *businesses enablers* such as incubators and networking associations, and finally *environmental enablers* such as regulatory framework, infrastructure and culture. By examining an entrepreneurial ecosystem through this framework the WEF is able to identify strengths and weaknesses in the ecosystem and recommend policy to fill gaps.



# Appendix II: Indicators for Assessing Entrepreneurial Ecosystem

## Guidance on Using Indicators

- The below list of indicators is intended to be a guide for developing an entrepreneurial ecosystem assessment, while recognizing that not all will be available or relevant in every context. Practitioners are encouraged to identify additional indicators that are relevant to their particular programs, and assessing the quality of available data using the criteria (relevance, accuracy, and availability) provided.
- We strongly recommend identifying comparable regions or benchmarks against which the region of interest is compared for this analysis.
- We expect many of these indicators to be available through existing data sources. Indicators that are likely to require primary data collection (through a survey), are denoted with a \*.

No.	Determinants	Quality of Indicators			
		Relevance	Accuracy	Availability	Overall
	<b>Finance</b>				
	<i>Banks</i>				
1	Amount of bank loans outstanding to regional businesses				
2	Average Interest rate spread				
3	Collateral Requirements				
	<i>Venture Capital/Angel Investors/Private Equity</i>				
4	Amount of assets invested in region (# of deals and investment amounts) - VC/Angel/PE				
5	Return on investments - VC/Angel/PE				
6	Co-investments with other regional investors - VC/Angel/PE				
7	Percentage of early stage investments				
	<i>Public Stock Market</i>				
8	Turnover in Stock Market				
9	Capitalization of Stock Market				
10	Newly Listed Companies in Stock Market				
	<i>Philanthropic Activity</i>				
11	Number of foundations and other philanthropic organizations in region				
12	Amount of donor grants in region (foundations)				
	<b>Business Support Services</b>				
	<i>Level of satisfaction with the quality and availability of business support services - legal, accounting, incubation, etc. *</i>				
13	Size of membership and budget of industry & network associations				



14	Number of networking activities and events				
15	Number of incubators and accelerators in region				
16	Average success rate for incubators and accelerators (% of graduates that are profitable or have received investment 5 years after program participation)				
	<b>Policy</b>				
17	Effective tax rates for region (vs. competitor regions)				
18	Amount provided in tax incentive programs				
19	Overall business satisfaction with business environment*				
20	Level of satisfaction with government services and programs*				
21	Cost to start a business				
22	Time to start a business (number of days)				
23	Time to start a business (number of steps)				
24	Cost to close a business				
25	Percentage of businesses that report paying a bribe*				
	<b>Markets</b>				
26	Sales to International Corporate Customers*				
27	Sales to Domestic Corporate Customers*				
28	Target market size (international)				
29	Target market size (domestic)				
	<b>Human Capital</b>				
30	High school graduation rates				
31	Job placement information				
32	College graduation rates				
33	Annual number of STEM graduates				
34	Business community satisfaction with quality of education, employability of graduates, private sector-academic collaboration*				
35	Quality and availability of entrepreneurship education*				
36	Quality of business schools (independent ratings, accreditations)				
	<b>Infrastructure</b>				
37	Availability of high speed internet access				
38	Availability of mobile networks				
39	Current level of business satisfaction with availability of connectivity services*				
40	Current level of business satisfaction with availability of utility services (electricity, water, gas, etc.)*				
41	Current level of business satisfaction with availability of transport services*				

42	Percent of businesses paying for security*				
43	Average cost of security (% of annual sales)*				
44	Losses due to theft and vandalism (% of annual sales)*				
<b>Research &amp; Development / Innovation</b>					
45	Number of patents and patenting rates (patents/ research dollars) for research centers and laboratories in region				
46	Spin-outs and major technology licensing deals				
<b>Entrepreneurial Culture</b>					
47	Entrepreneurial motivation in society*				
48	Proclivity for risk*				
49	Cultural and social norms				
50	Media narratives of entrepreneurship				
<b>Entrepreneurial Performance</b>					
51	Enterprise birth rates				
52	Enterprise death rates				
53	Rate of high growth firms, based on employment growth				
54	Rate of high growth firms, based on turnover growth				
55	Survival rates at 3 and 5 years				
56	Proportion of 3 and 5 year old firms				
57	Productivity contribution (young or small firms)				
58	Innovation performance (young or small firms)				
59	Export performance (young or small firms)				
<b>Impact</b>					
60	GDP Growth				
61	Gini Coefficient				
62	Net job creation				
63	Average/Median wages & salaries				
64	Job quality				
65	Poverty rates				

# Appendix III – Ecosystem Survey Instrument Introduction

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This survey instrument is designed to provide a relatively quick, but holistic assessment of the entrepreneurial ecosystem in a region, from the perspective of the firm. The survey uses a combination of objective indicators of firm performance and entrepreneurial perceptions of the business environment. To be most accurate and effective in informing specific projects, we recommend implementing this survey at a local or metropolitan region level and with a focus on key economic sectors. However, it may also be used at larger geographic units of analysis, and across sectors. This firm level survey is designed to supplement existing data that is typically available from government agencies and industry associations, and more qualitative interviews with key stakeholders and local experts. The survey will be most useful if practitioners are able to implement it on an annual basis as a means of tracking progress from a baseline.

The questions in this survey have been specifically selected to provide actionable guidance for practitioners that aim to address key obstacles in entrepreneurial development in a region. Additional sector-specific questions may be added to the survey. The survey is currently designed to be implemented online, but may also be adapted to in-person survey methods, which may be necessary in some regions. Finally, note that not all sections in the survey will be relevant for every region or sector.

Users are encouraged to modify and adapt this survey instrument to the local context and the nature of the program(s) being implemented. We also recommend testing the survey with a small group of entrepreneurs and local experts to get feedback and refine the instrument.

This survey is divided into three sections:

- I. Demographic Information
- II. Entrepreneurial Perceptions of the Ecosystem
- III. Key Firm and Entrepreneur Indicators

The questions used in the survey were drawn from the following sources:

1. World Bank Enterprise Surveys
2. Council on Competitiveness Asset Mapping Roadmap
3. Global Entrepreneurship Monitor
4. Global Impact of Entrepreneurship Database
5. Aspen Network of Development Entrepreneurs

In particular, there are significant number of questions from the World Bank's Enterprise Surveys, which is the most comprehensive and validated survey of entrepreneurs globally. Enterprise Surveys have been conducted in 135 countries, with over 130,000 firms, allowing practitioners to most effectively compare the local ecosystem with national and sub-national benchmarks. For more information about the Enterprise Surveys, please see the following link: <http://www.enterprisesurveys.org/>

To conduct more detailed analyses of attitudes towards entrepreneurship, we recommend using the survey instruments from the Global Entrepreneurship Monitor and the Council on Competitiveness.

## Sampling Methodology

We recommend the sampling methodology employed by the World Bank’s Enterprise Surveys, which provides guidance on developing a stratified random sample of firms in a region, and can be adjusted depending on the level of desired statistical precision. Stratified random samples are generated by classifying firms into three categories (size, geographic location, and sector), and drawing a random sample from each category. However, stratified random sampling may not be appropriate for small regions, or for programs with small budgets.

The minimum recommended level is 7.5% for 90% confidence intervals, which means that the “true” population parameter is within the 7.5% range of the observed sample estimate, 90% of the time. Typical sample sizes for 90% confidence are provided in Table 1. However, non-responses, missing answers, and attrition (for follow-on surveys), are a critical problem with many firm-level surveys. The Enterprise Surveys recommend factoring a 25% non-response rate per stratum, and over-sampling accordingly. Additional guidance on sampling methodology is provided here: <http://www.enterprisesurveys.org/Methodology>

**Table 1: Typical Sample Sizes Required for 5% and 7.5% Precision and 90% Confidence<sup>1</sup>**

Population Size (Total Number of Firms)	Sample Size - 5% Precision	Sample Size – 7.5% Precision
100	73	55
200	115	75
400	162	93
800	202	105
1,000	213	107
1,500	229	111
2,000	238	113
5,000	257	117
10,000	263	119
50,000	269	120
100,000	270	120

1 World Bank Enterprise Surveys - Methodology

# Ecosystem Survey Instrument

## *I. Demographic Information*

1. Type of firm(Select One):    \_\_\_ Manufacturing                    \_\_\_ Services
2. Number of Employees (Number):
3. Sector (Select One): *[Add/Remove Sectors if necessary]*
  - o Food
  - o Tobacco
  - o Textiles
  - o Garments
  - o Leather
  - o Wood
  - o Paper
  - o Publishing (Print and Recorded Media)
  - o Refined Petroleum Products
  - o Chemicals
  - o Plastics and Rubber
  - o Non-metallic Mineral Products
  - o Basic Metals
  - o Fabricated Metal Products
  - o Machinery and Equipment
  - o Electronics
  - o Precision Instruments
  - o Transport Machines
  - o Furniture
  - o Recycling
  - o Retail
  - o Wholesale
  - o Information and Communication Technology
  - o Hotel and Restaurant
  - o Service of Motor Vehicles
  - o Construction
  - o Transport
4. Address (Text):
5. Legal Status (Select One): *[use locally relevant classifications]*
  - o Corporation
  - o Limited Liability Company
  - o ...
6. Year founded (Date):
7. Year of formal registration (if different) (Date):

8. Please complete the following information for each firm owner:

	<i>Age</i>	<i>Gender</i>	<i>% of Ownership</i>	<i>Highest Level of Education</i>	<i>Years of Work Experience</i>	<i>Number of Ventures founded previously</i>
Founder 1						
Founder 2						

9. Is the Top Manager female? (Y/N)

## II. Entrepreneurial Perceptions of the Ecosystem

10. To what degree are the following elements of *Finance* an obstacle to current operations of this firm:

<b>Finance</b>							
	<i>No Obstacle</i>	<i>Minor Obstacle</i>	<i>Moderate Obstacle</i>	<i>Major Obstacle</i>	<i>Very Severe Obstacle</i>	<i>Don't Know</i>	<i>N/A</i>
Access to Debt Finance							
Access to Equity Finance							
Access to Grants							

11. To what degree are the following elements of *Business Support Services* an obstacle to current operations of this firm:

<b>Business Support Services</b>							
	<i>No Obstacle</i>	<i>Minor Obstacle</i>	<i>Moderate Obstacle</i>	<i>Major Obstacle</i>	<i>Very Severe Obstacle</i>	<i>Don't Know</i>	<i>N/A</i>
Access to Legal Services							
Access to Tax Services							
Access to Incubators/ Accelerators							
Access to Consultants/ Advisors							

12. To what degree are the following elements of the *Policy Environment* an obstacle to current operations of this firm:

Policy							
	<i>No Obstacle</i>	<i>Minor Obstacle</i>	<i>Moderate Obstacle</i>	<i>Major Obstacle</i>	<i>Very Severe Obstacle</i>	<i>Don't Know</i>	<i>N/A</i>
Business Licensing and Permits							
Customs and Trade Regulations							
Labour Regulations							
Tax Administration							
Tax Rates							

13. To what degree are the following elements of the *Market* an obstacle to current operations of this firm:

Markets							
	<i>No Obstacle</i>	<i>Minor Obstacle</i>	<i>Moderate Obstacle</i>	<i>Major Obstacle</i>	<i>Very Severe Obstacle</i>	<i>Don't Know</i>	<i>N/A</i>
Access to International Markets							
Availability of Market Information							

14. To what degree are the following elements of *Human Capital* an obstacle to current operations of this firm:

Human Capital							
	<i>No Obstacle</i>	<i>Minor Obstacle</i>	<i>Moderate Obstacle</i>	<i>Major Obstacle</i>	<i>Very Severe Obstacle</i>	<i>Don't Know</i>	<i>N/A</i>
Availability of top managers with the qualifications your business requires							
Availability of scientists and engineers with the qualifications your business requires							
Inadequately educated/trained general workforce							

15. To what degree are the following elements of *Infrastructure* an obstacle to current operations of this firm:

Infrastructure							
	<i>No Obstacle</i>	<i>Minor Obstacle</i>	<i>Moderate Obstacle</i>	<i>Major Obstacle</i>	<i>Very Severe Obstacle</i>	<i>Don't Know</i>	<i>N/A</i>
Electricity							
Telecom/Internet							
Water							
Gas							
Transport							

16. To what degree are the following elements of the *Business Environment* an obstacle to current operations of this firm:

Business Environment							
	<i>No Obstacle</i>	<i>Minor Obstacle</i>	<i>Moderate Obstacle</i>	<i>Major Obstacle</i>	<i>Very Severe Obstacle</i>	<i>Don't Know</i>	<i>N/A</i>
Level of support from successful business people in the region							
Political Instability							
Practices of informal sector competitors							
R&D collaboration between businesses and university researchers							
Corruption							
Crime, theft and disorder							
Overall business environment (in region)							



### III. Key Firm and Entrepreneur Indicators

#### Finance

17. During FY (insert last FY), how much equity financing did this firm obtain from all of these outside sources?

<i>Source</i>	<i>Amount of Funding Sought</i>	<i>Amount of Funding Received</i>	<i>Equity Stake (if applicable)</i>
Family and Friends			
Angel Investors			
Venture Capital			
Foundations			
Other Companies			
Government Agencies			
Social Impact Investors			
Other			
N/A (None)			

18. During FY (insert last FY), how much debt financing did this firm obtain from all of these outside sources?

<i>Source</i>	<i>Amount of Funding Sought</i>	<i>Amount of Funding Received</i>	<i>Term of Loan (Months)</i>	<i>Interest Rate (Percentage)</i>
Banks				
Microfinance Institutions				
Other				
N/A (None)				

19. During FY (insert last FY), how much grant funding did this firm obtain from all of these outside sources?

<i>Source</i>	<i>Amount of Funding Sought</i>	<i>Amount of Funding Received</i>	<i>Grant Period (Months)</i>
Foundations			
Government Agencies			
International Aid Agencies			
Other			
N/A (None)			

20. How much additional capital of the following kinds are you seeking?

<i>Type of Capital</i>	<i>Next 12 months (1 year)</i>	<i>Next 36 months (3 years)</i>
Equity		
Debt		
Grants		
N/A (None)		

*Markets and Sales*

- 21. In FY (insert last FY), what was this firm’s main activity, product or service (that represented the largest proportion of annual sales)? (Detailed description)
- 22. What percentage of sales does the main product or activity represent? (Percentage)
- 23. What was this firm’s profit margin (as a percentage of total investment) for FY (insert last FY)
  - a) Negative ROI (Loss)
  - b) 0-5%
  - c) 6-10%
  - d) 11-15%
  - e) 16-20%
  - f) More than 20%
  - g) Unsure
  - h) N/A (e.g., nonprofit)
- 24. In FY (insert last FY), what were this firm’s total annual sales for all products and services?
- 25. In FY (insert last FY minus 2), three years ago, what were total annual sales for this firm? (Number)
- 26. In FY (insert last FY minus 4), 5 years ago, what were total annual sales for this firm? (Number)
- 27. In FY (insert last FY), what percentage of firm’s sales were (Percentage)
  - a) National sales
  - b) Indirect exports (sold domestically to third party that exports)
  - c) Direct exports
- 28. In which year did this firm first export directly or indirectly? (Date)
- 29. In FY (insert last FY), what percentage of the value of products shipped was lost due to crime or theft? (Percentage)

*Human Capital*

- 30. In FY (insert last FY), how many permanent, full-time individuals worked in this firm?
- 31. In FY (insert FY minus 2), three years ago, how many permanent, full-time individuals worked in this firm?
- 32. In FY (year of founding), how many permanent, full-time individuals worked in this firm?
- 33. In FY (insert last FY), how many temporary, full-time individuals worked in this firm?
- 34. In FY (insert FY minus 2), three years ago, how many temporary, full-time individuals worked in this firm?
- 35. In FY (year of founding), how many temporary, full-time individuals worked in this firm?

*Infrastructure*

36. Delivery of Infrastructure and Services:

	<i>Applied for connection/ permit (Y/N)</i>	<i>Number of Days to Receive a Connection/ approval</i>	<i>Informal gift/ payment expected or requested (Y/N)</i>
Electricity			
Telecom/Internet			
Water			
Gas			
Construction permit			

*Research and Development/Innovation*

37. Does your firm have any of the following? If so, please provide the number, and a brief description:

	<i>Number</i>	<i>Brief Description</i>
Patents		
Copyrights		
Trademarks		

38. Has your firm introduced any new or significantly improved products or services in the past 3 years? Please provide a brief description: (open-ended)

39. Has your firm introduced any new or significantly improved processes or methods in past 3 years? Please provide a brief description: (open-ended)

*Business Support Services*

40. What capacity development services does your firm require?

41. Have you ever participated in a business incubation or acceleration program?

42. If yes, which program(s)?

43. Please state your level of satisfaction with the following services/activities provided by the incubation and acceleration programs:

	<i>Not Useful</i>	<i>Slightly Useful</i>	<i>Moderately Useful</i>	<i>Very Useful</i>	<i>Extremely Useful</i>	<i>Don't Know</i>	<i>N/A</i>
Network development							
Business skills development							
Mentorship							
Access to Investors/Funders							
Securing Direct Funding							
Access to like-minded entrepreneurs							
Awareness and Credibility							

44. Are you involved in this start-up to take advantage of a business opportunity or because you have no better choices for work?

- Take advantage of business opportunity
- No better choices for work
- Combination of both of the above
- Have a job but seek better opportunities
- Other (Please specify)
- Don't Know

45. Which one of the following do you feel is the most important motive for pursuing this opportunity?

- Greater independence
- Increase personal income
- Just to maintain income
- Other (Please specify)
- Don't Know

## Appendix IV: List of Economic Datasets (Summary)

	Organization	Unit of Analysis	Possible types of analysis	Type of dataset	Availability	Link
<b>Global Datasets</b>						
<b>Enterprise Survey</b>	World Bank	Firm	Global; national in some cases	Longitudinal for some countries, from 2005	Public use (requires registration)	<a href="http://www.enterprisesurveys.org/">http://www.enterprisesurveys.org/</a>
<b>GEDI (Global Entrepreneurship and Development Index)</b>	George Mason University	Firm, individual (entrepreneur)	Global, regional, national	Longitudinal, from 2008	Electronic version: \$31.20	<a href="http://www.thegedi.org/">http://www.thegedi.org/</a>
<b>IRIS</b>	Global Impact Investing Network (GIIN)	Firm	Global, regional, national	Longitudinal from 2008	Not available for public use	<a href="http://iris.thegiin.org/">http://iris.thegiin.org/</a>
<b>GEM (Global Entrepreneurship Monitor)</b>	Global Entrepreneurship Research Association, UK	Country, individual (entrepreneur)	Global, regional, national	Longitudinal, from 1999 (though very few countries in the earliest years)	Public use; full individual-level datasets available exclusively to GEM National Team members until 3 years after data collection	<a href="http://www.gemconsortium.org/">http://www.gemconsortium.org/</a>
<b>Doing Business</b>	World Bank	Country	Global, regional, national in some cases	Longitudinal	Public use	<a href="http://www.doingbusiness.org/">http://www.doingbusiness.org/</a>
<b>Global Competitiveness Index</b>	World Economic Forum	Country	Global, regional	Longitudinal, from 2008	Public use	<a href="http://www.weforum.org/issues/competitiveness-0/gci2012-data-platform/">http://www.weforum.org/issues/competitiveness-0/gci2012-data-platform/</a>

<b>World Economic Outlook</b>	International Monetary Fund	Country, aggregated country groups	Global, regional	Longitudinal from 1980	Public use	
<b>World Competitive-ness Report</b>	International Institute for Management Development (IMD)	Country (but very limited selections in the developing world; very little on Africa)	Global, regional	Longitudinal from 1989	\$600 for most recent report	<a href="http://www.imd.org/wcc/">http://www.imd.org/wcc/</a>
<b>Index of Economic Freedom</b>	Heritage Foundation	Country	Global, regional	Longitudinal from 1985	Public use	<a href="http://www.heritage.org/index/">http://www.heritage.org/index/</a>
<b>Economic Freedom of the World</b>	Fraser Institute	Country	Global, regional	Longitudinal from 1970 (from 1970-2000, available on a 5-year basis only)	Public use	<a href="http://www.freetheworld.com/">http://www.freetheworld.com/</a>
<b>Investment Climate Surveys</b>	World Bank	Country	Global, regional	Cross-section	Public use (requires registration)	<a href="https://www.wbginvestmentclimate.org/">https://www.wbginvestmentclimate.org/</a>
<b>Business Environment and Enterprise Performance Surveys (BEEPS)</b>	European Bank for Reconstruction and Development (EBRD)	Country	Global, regional	Panel from 2002-2009	Public use	<a href="http://www.ebrd.com/english/pages/research/economics/data.shtml">http://www.ebrd.com/english/pages/research/economics/data.shtml</a>
<b>Living Standards Measurement Surveys</b>	World Bank	Individual (households)	Global, regional, national	Panels available for some countries	Public use	<a href="http://iresearch.worldbank.org/LSMS/lsmsSurveyFinder.htm">http://iresearch.worldbank.org/LSMS/lsmsSurveyFinder.htm</a>
<b>Labour Force Surveys</b>	International Labour Organisation	Individual (workforce)	Global, regional, national	Panel (though only 2002-03 seems to be available online)	Public use	<a href="http://www.ilo.org/dyn/lfsurvey/lfsurvey.home">http://www.ilo.org/dyn/lfsurvey/lfsurvey.home</a>
<b>International Household Survey Network</b>		Individual	Global, regional, national	Catalog of Datasets	Public use (requires registration)	<a href="http://www.ihnsn.org/home/">http://www.ihnsn.org/home/</a>

Africa						
Regional Program on Enterprise Development data	Centre for the Study of African Economies (CSAE)	Firm	Ghana, Tanzania, Zimbabwe, Kenya, Ethiopia			<a href="http://www.csae.ox.ac.uk/datasets/main.html">http://www.csae.ox.ac.uk/datasets/main.html</a>
Tanzanian Manufacturing Enterprise Survey/RPED	Centre for the Study of African Economies (CSAE)	Firm	Tanzania	Matched panels from 1992-1998	Public use	<a href="http://www.csae.ox.ac.uk/datasets/main.html">http://www.csae.ox.ac.uk/datasets/main.html</a>
Ethiopian Addis Ababa Industrial Survey	CSAE, Economics Dept. of Addis Ababa University	Firm	Ethiopia	Cross-section from 1993 (first wave released; more waves to follow)	Public use	<a href="http://www.csae.ox.ac.uk/datasets/main.html">http://www.csae.ox.ac.uk/datasets/main.html</a>
Ghana Manufacturing Enterprise Survey/RPED	Ghana Statistical Office, CSAE	Firm	Ghana	Longitudinal from 1991-2002	Public use	<a href="http://www.csae.ox.ac.uk/datasets/main.html">http://www.csae.ox.ac.uk/datasets/main.html</a>
Kenyan Manufacturing Enterprise Survey	CSAE, UNIDO	Firm	Kenya			<a href="http://www.csae.ox.ac.uk/datasets/main.html">http://www.csae.ox.ac.uk/datasets/main.html</a>
Moroccan Firm Analysis and Competitiveness Survey	World Bank and Moroccan Ministry of Industry	Firm, Individual	Morocco	Matched panel	Public use	n/a
Ghana Industrial Census	Ghana Statistical Service	Firm, Individual	Ghana	Cross-section from 1993, 2003	Public use	<a href="http://www.statsghana.gov.gh/nada/index.php/catalog/33">http://www.statsghana.gov.gh/nada/index.php/catalog/33</a>
South African Standardised Industry Survey	Quantec	Firm	South Africa	Time series	Requires a subscription	<a href="http://www.quantec.co.za/easydata/industry-subscription/">http://www.quantec.co.za/easydata/industry-subscription/</a>
Ghana and Tanzania Urban Household Panel Surveys	CSAE, Ghana Statistical Office (GSO) and Tanzania National Bureau of Statistics (NBS)	Individual, Household	Ghana and Tanzania	Matched panels from 2004-2005	Public use	<a href="http://www.csae.ox.ac.uk/datasets/main.html">http://www.csae.ox.ac.uk/datasets/main.html</a>
Ghana Living Standard Survey (GLSS)	CSAE, World Bank's RPED	Individual, Household	Ghana	Longitudinal from 1987-2005	Public use	<a href="http://www.csae.ox.ac.uk/datasets/main.html">http://www.csae.ox.ac.uk/datasets/main.html</a>



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