



Impact Inventing:

Strengthening the Ecosystem for Invention-Based Entrepreneurship in Emerging Markets

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September 2014



Acknowledgements

This report would not have been possible without the generous support and guidance of The Lemelson Foundation, who supported a series of invention roundtables in celebration of 20 years of promoting invention, innovation and entrepreneurship to improve lives. Outputs of these roundtables are reflected in this report. We are also grateful for the support of World Transforming Technologies (WTT) for making the Brazil Roundtable possible, The Bertha Center for Social Innovation and Entrepreneurship for hosting the South Africa Roundtable, and Strathmore University for hosting the Kenya Roundtable. In addition, we would like to thank The American Society for Mechanical Engineers (ASME) and The Global Social Benefit Incubator at Santa Clara University for their partnership in organizing the preliminary Santa Clara Roundtable; with a special thanks to Paul Scott of ASME for his research support and guidance.

We would also like to thank ANDE's Regional Coordinators, Bridget Fury, Mary Mwangi, Aditya Pant, Rebeca Rocha, and Lisa Van Eck for their organization of the individual roundtable discussions, and to all of the individuals who participated in this research and the roundtable discussions. In addition, we would like to thank all of those who participated in interviews and contributed to the design and execution of the roundtables.

About this Report

The Lemelson Foundation and ANDE partnered to promote a series of invention roundtables in 2014 in Brazil, India, Kenya, South Africa, and the United States, focused on the challenges and opportunities facing inventors and invention-based small and growing businesses in emerging markets. These roundtables gathered important global, regional and local actors interested in invention, innovation and entrepreneurship. In particular, these roundtables were aimed at identifying collaborative actions intermediaries might collectively take in particular regions.

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EXECUTIVE SUMMARY

Over the past decade, a growing segment of social entrepreneurs and small and growing businesses (SGBs) has emerged that seeks to utilize the power of invention to create products and companies that improve the lives of people living in poverty around the world. We call this class of entrepreneur - looking to develop and disseminate tangible products that will be manufactured and sold at high volumes via market mechanisms - an invention-based entrepreneur.¹ ANDE believes that invention-based entrepreneurs are supported or impeded by a number of environmental factors, or the entrepreneurial ecosystem in which they work. While ANDE and our members have made significant progress toward strengthening these entrepreneurial ecosystems in emerging markets, invention-based entrepreneurs have a unique set of needs that differentiates them from typical SGBs. Consequently, we believe we can improve the ecosystem to support the growth of this industry, and thereby unleash the full potential impact of these invention-based entrepreneurs.

This report focuses on what differentiates an invention-based entrepreneur from traditional entrepreneurs and highlights what support invention-based entrepreneurs require, what resources are available, what ecosystem level gaps remain, and what tangible actions can be taken to fill these gaps. It is based primarily on a series of roundtable discussions held in Brazil, India, Kenya, and South Africa, and is supplemented by both one-on-one expert interviews and quantitative survey data.

Through this work we have identified five major ecosystem gaps that stymie the growth of invention-based enterprises in emerging markets. These five gaps are: the Market Gap, the Finance Gap, the Talent Gap, the Policy Gap and the Physical Capital Gap.

Market Gap

One of the biggest sources of failure for many technologies intended to serve the BOP has been the difficulty of early-stage SGBs in identifying their place within the value chain, which leads to poor market adoption. This difficulty can stem from a number of sources including designing contextually misaligned products, inability to collect accurate customer feedback early and often, consumers' inability to pay for products, and difficulty in marketing products that address a problem of which the consumers are unaware.

This research revealed a number of ways the ecosystem can help entrepreneurs efficiently overcome these challenges through collaborative action. These included forming community level partnerships, investing in technology based survey and sensing tools, leveraging the talent pool of universities and building stronger industry associations.

Financing Gap

The process of developing new technology-based products for the BOP can be expensive, time consuming, and risky. Furthermore many investors are unfamiliar with and, thus, unwilling to invest

¹ Please see Sanergy case study on page 22 for an example of an invention-based enterprise

in invention-based enterprises. The physical nature of invention - as opposed to purely business innovations or app based enterprises - adds an additional layer of complexity which often deters potential investors. These factors include, but are not limited to, more intensive physical prototyping, complicated manufacturing, and the need to maintain a physical inventory. When investors do engage with invention-based entrepreneurs, the investment mechanisms at their disposal are often ill-suited to the unique requirements of the technology development process.

Collaborative partnerships and coordination between different classes of investors can help to overcome the limitations of any one investor, or any one investment instrument. Furthermore invention-based entrepreneurs lack a good sense of which investors are potentially interested in investing in them, and the investment instrument (e.g. grant, loan, equity or hybrid) that is best suited for their particular stage of product development. By better mapping the landscape of funders and educating entrepreneurs, the entrepreneur's ability to navigate to the appropriate funders would be enhanced.

Talent Gap

Access to talent is a major barrier to growth for all SGBs but the talent gap for invention-based enterprises is further complicated because these ventures require both entrepreneurial skill and technical expertise. These unique talent requirements of an invention-based enterprise cause several distinct talent gaps throughout the life cycle of an invention. There is a lack of socially motivated and entrepreneurial engineers in the university system; there is a lack of capacity development support for invention-based entrepreneurs; and there is a shortage of qualified engineering talent with business skills.

The ecosystem can help fill this talent gap by forming more productive partnerships with universities and technical institutes to ensure the skills of graduates meet the needs of invention-based enterprises, and to ensure a healthy flow of engineering talent is motivated to pursue careers in social entrepreneurship. In addition, enhanced access to technical advice and mentorship can be created by augmenting the technical expertise of capacity development providers through partnership development and by creating new invention-focused incubators and accelerators.

Policy Gap

Government policy plays a major role in shaping the entrepreneurial ecosystem. This research found that invention-based entrepreneurs are particularly affected by several policy areas including R&D incentives, intellectual property rights, and access to raw materials. While this research revealed several ecosystem level actions that could be taken to help overcome the specific policy challenges of each country, a broader overarching theme emerged. Participants claimed that small, invention based enterprises have virtually no ability to conduct policy advocacy. Consequently, many policy environments favor large companies and make business difficult for small invention-based entrepreneurs. Among other specific actions, building more cohesive communities around invention-based entrepreneurship can help the industry advocate for a more friendly policy environment.

Physical Capital Gap

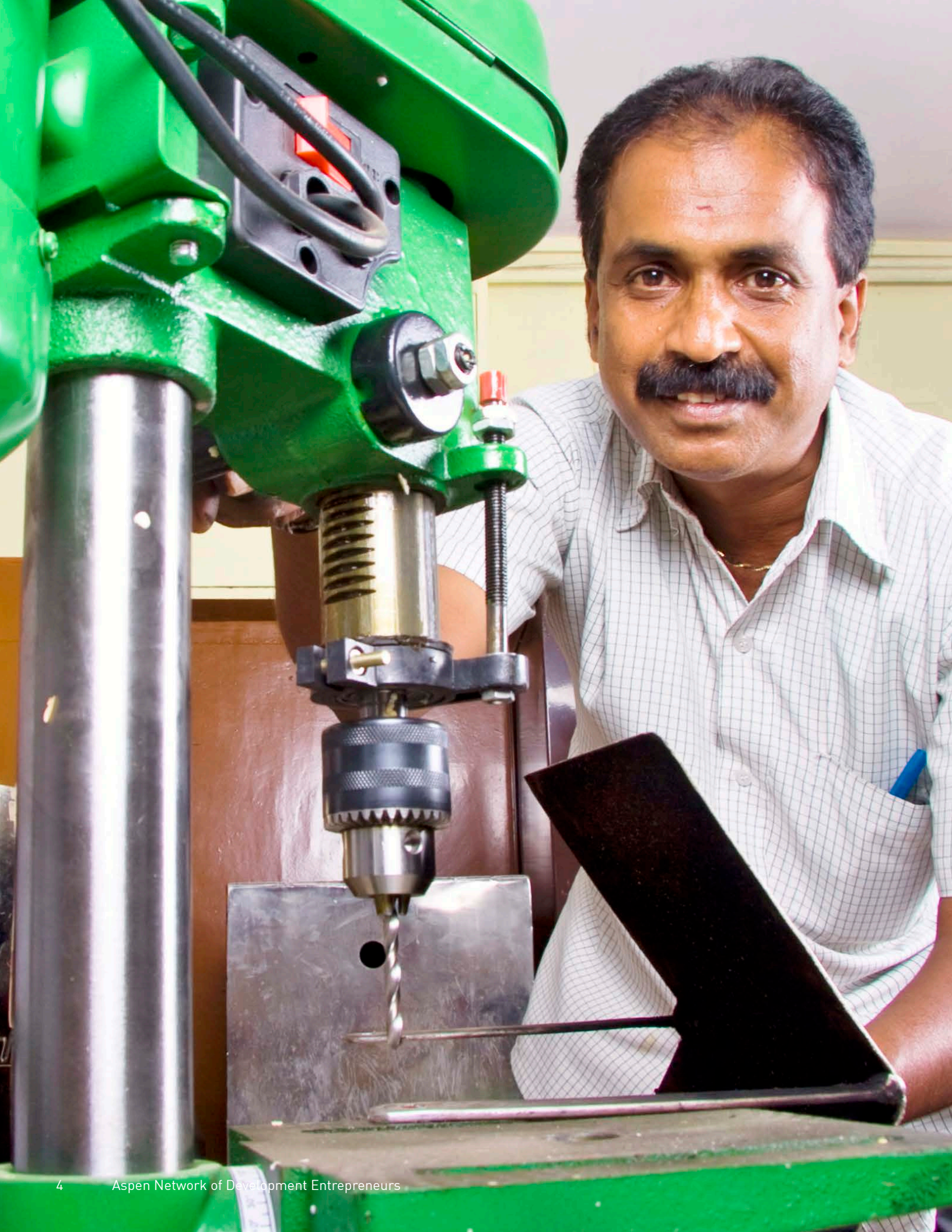
Turning an idea into a viable product requires several stages of prototyping. In emerging markets this can be extremely expensive and time-consuming as the required physical equipment is generally not available locally. Many entrepreneurs are either forced to prototype abroad, acquire the necessary equipment and materials themselves, or work through informal partnerships to gain access to university, government, or corporate labs and equipment. Each of these options can prove to be costly and time consuming.

The roundtable discussions revealed that a great deal of the required prototyping equipment may actually be present in major urban areas. However, entrepreneurs either don't know about these resources, or don't have access to these resources. Developing more formalized partnerships with the owners of this equipment and incentivizing access may be one way forward. This research also highlighted a number of efforts to create professional engineering, prototyping and small-scale manufacturing spaces for social ventures in emerging markets that aim to provide shared access to physical equipment.

Recommendations

Participants in the roundtable series identified several critical areas of activity where further exploration and collaborative action could greatly strengthen the ecosystem for invention-based entrepreneurship.

- **Map the Ecosystem.** The Ecosystem is stronger than it may appear. Better mapping of available resources and effective dissemination of these resources will enable invention based entrepreneurs to navigate to the resources they need to grow.
- **Create a Community.** A community of those engaging in invention-based entrepreneurship, or interested in supporting it, must be created in order to facilitate continued knowledge sharing and collaboration. Roundtable discussions like this are a good place to start, but the conversations must continue.
- **Engage the Universities.** Universities need to be more entrepreneurial but can not be expected to make this transition on their own. The ecosystem can help facilitate this transition through partnerships and collaboration.
- **Articulate Value to Corporate Partners.** Corporate partnerships can benefit the ecosystem, but cannot be purely philanthropically motivated. The value proposition needs to be made clearer and ecosystem level partnerships can help to create value by offering scale.
- **Closing ecosystem gaps will help unlock financing.** The financing gap is in many ways a manifestation of the other four ecosystems gaps. By focusing efforts on creating a stronger ecosystem, and making invention easier, financing in turn will become easier.

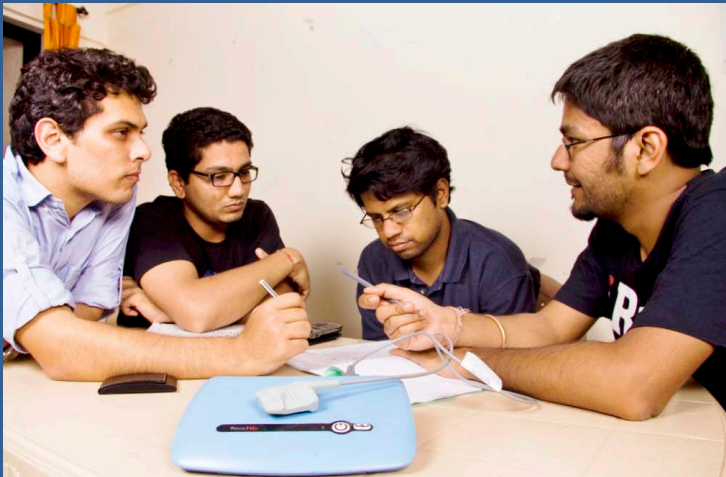


INTRODUCTION

Over the past decade, a growing segment of social entrepreneurs and small and growing businesses(SGBs) has emerged that seeks to utilize the power of invention to create products and companies that improve the lives of people living in poverty around the world. We call this class of entrepreneur - looking to develop and disseminate tangible products that will be manufactured and sold at high volumes via market mechanisms - an invention-based entrepreneur.

What is Invention-based entrepreneurship?

We use the term invention-based entrepreneurship/ enterprise to refer to the sub-set of technology-based entrepreneurs that focus on developing and commercializing new tangible products that serve the needs of those living at the base of the pyramid (BOP). We use this term to differentiate these "hardware" based enterprises from those working to develop ICT or "software" based technologies for the BOP. We make this differentiation because we believe that invention-based entrepreneurs face a unique set of challenges that warrants further exploration .



What is a Small and Growing Business?

Supporting small and growing business is at the core of ANDE’s mission. Small and Growing Businesses (SGBs) are defined by ANDE as commercially viable businesses with five to 250 employees that have significant potential, and ambition, for growth. Typically, SGBs seek growth capital from \$20,000 to \$2 million. SGBs differ from the more traditional characterization of small and medium enterprises (SMEs) in two fundamental ways. First, SGBs are different from livelihood-sustaining small businesses, which start small and are designed to stay that way. Second, unlike many medium-sized companies, SGBs often lack access to the financial and knowledge resources required for growth.

Since 2009 ANDE has worked to support and scale small and growing businesses (SGBs), including invention-based enterprises, by building vibrant entrepreneurial ecosystems and facilitating collaboration and knowledge sharing across the sector. However, as this segment of invention-based SGBs grows in prevalence, our members are increasingly struggling to engage with them and support their growth.

This report focuses on what differentiates an invention-based entrepreneur from traditional entrepreneurs and highlights what support invention-based entrepreneurs require, what resources are available, what ecosystem level gaps remain, and what tangible actions can be taken to fill these gaps.

This report is primarily aimed at ecosystem level actors and intermediaries that support invention-based entrepreneurs in emerging markets. This includes but is not limited to investors, capacity development providers, policy makers, academics, universities, and corporations.

The Opportunity for Invention-Based Enterprises

Invention-based enterprises in emerging markets have an incredible potential to improve the lives of those living at the base of the pyramid, not only through the creation and delivery of cutting edge and appropriate goods and services, but also by creating jobs and increasing income to the poor. While the recognition of science, technology, and innovation's importance in international development is not a new development, it has recently garnered much more institutionalized support. The United States Agency for International Development (USAID) has created the US Global Development Lab; the World Bank has Infodev, a program on science technology and entrepreneurship; and the OECD has launched The Innovation Policy Platform.

International organizations also increasingly recognize entrepreneurship as a driving force in innovation. Evolving global value chains, increased internet access and mobile penetration, increasingly niche markets, a growing emphasis on non-technological design, and increased inter-sectorial collaboration have all reduced the competitive advantage of large firms and reduced barriers to entry for small, innovative, technology-based firms.¹ In addition, there is growing recognition that last mile delivery and distribution of new technologies to the BOP is one of the most difficult barriers for large firms to overcome. The SGB sector can not only create innovative and viable solutions, but has a unique ability to commercialize these innovations and create scalable, sustainable businesses to deliver these products. According to the OECD, "new and small firms have become critical innovation players because of their ability to recognize and exploit the commercial opportunities emerging from technological, competitive and market changes."²

The confluence of this institutional trend toward science and technology for development, and the critical role SGBs play in both creating and delivering technologies to the BOP, has created a promising opportunity. However, the full potential impact of these invention-based enterprises has been constrained as entrepreneurs struggle to scale their businesses. ANDE believes that invention-based entrepreneurs, like traditional entrepreneurs, are supported or impeded by a number of environmental factors. There is a metaphorical ecosystem of institutions and intermediary organizations that, when present, allow entrepreneurship to flourish; but when absent, can stymie entrepreneurship altogether.

The Ecosystem for Entrepreneurship

The importance of entrepreneurial ecosystems has been recognized by a wide variety of organizations including governments, universities, multilateral institutions, academic researchers, private sector consultants, and nonprofits. Many of these organizations have put forward their own diagnostic tools or frameworks in order to give structure to the analysis of an entrepreneurial ecosystem.

While the specific elements and organizations that make up an entrepreneurial ecosystem vary from framework to framework, ANDE believes it is possible to group the essential elements of an entrepreneurial ecosystem into eight domains. These are: finance, business support services, policy, markets, human capital, infrastructure, R&D, and culture. For more information, please see ANDE's Entrepreneurial Ecosystem Diagnostic Toolkit.³

While ANDE and our members have made significant progress toward strengthening the entrepreneurial ecosystem that supports small and growing businesses in emerging markets, it appears that invention-based entrepreneurs have a unique set of needs that differentiates them from the typical SGB. For example, when it comes to human capital, invention-based enterprises need both high quality scientific and engineering talent as well as highly skilled business professionals. In addition, access to physical space and machinery to prototype and iterate on products is crucial.

Because of these and other unique requirements, it appears that entrepreneurial support organizations are struggling to engage with and support this sub-segment of entrepreneurs. In order to unleash the full potential impact of invention-based entrepreneurs, the gaps in the ecosystem that supports them must be better understood and targeted collaborative action must be taken in order to fill these gaps.

Global Ecosystems vs. Local Ecosystems

ANDE believes that while entrepreneurs worldwide generally require the same ecosystem elements to succeed, for any individual entrepreneur the local ecosystem of support is much more influential in enabling success. Similarly, while all invention-based entrepreneurs require similar support, it is useful to identify what resources are available to entrepreneurs at a local level, and understand what particular challenges exist in a local context.



Methodology

This report is a summary output of various related activities undertaken in 2014. First, we conducted targeted, one hour long, semi-structured interviews with experts who represented a variety of different ecosystem actors. Overall 15 interviews were conducted with 13 different organizations. We also participated in a roundtable discussion organized by The American Society for Mechanical Engineers, The Global Social Benefit Incubator at Santa Clara University, The Lemelson Foundation, and The Aspen Network of Development Entrepreneurs. This roundtable was instrumental in the development of the agendas for the global roundtable sessions. This research also informed the ecosystem gap framework presented below.

The majority of the research presented in this report was drawn from this series of roundtable discussions held in Brazil, India, Kenya and South Africa. Over 110 participants from approximately 90 organizations attended the roundtables. While each of these roundtables followed the ecosystem gap framework, agendas and topics of discussion were modified from region to region to capture the issues that were most important in each local context. The findings of this report are based on the comments and opinions of the participants. While every effort was made to ensure that these comments were consistent with sentiments of the overall group, they do not reflect the opinions of every participant.

We also developed a brief survey instrument to augment the qualitative findings of the interviews and roundtables with a basic level of quantitative data. All roundtable participants were invited to complete the survey and 106 participants did so.

Findings

Through the series of one-on-one interviews, and the Santa Clara Roundtable, a number of ecosystem challenges emerged.⁴ By analyzing the interview transcripts and discussion notes, it became apparent that a vast majority of the challenges could be categorized into one of five broad categories, or ecosystem gaps. These ecosystem gaps prevent the growth of invention-based enterprises in emerging markets and prevent the realization of invention’s full potential to improve the condition of those living at the base of the pyramid.

These five gaps are: the Market Gap, the Finance Gap, the Talent Gap, the Policy Gap and the Physical Capital Gap.

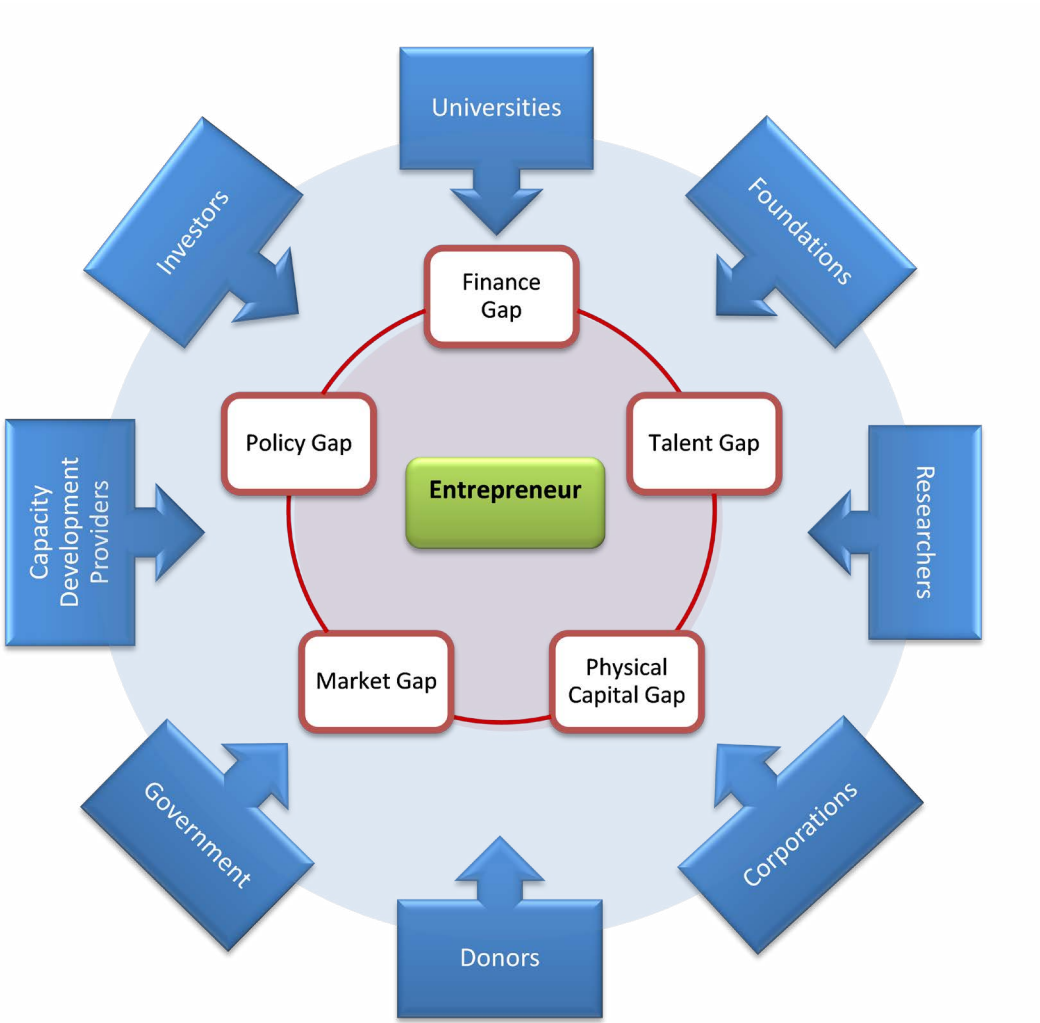


Table 1: Significance of Ecosystem Gaps

“Please rate each of the following barriers based on how significant they are in preventing the success of invention-based entrepreneurs.”

Rank	Ecosystem Gap	Significant or Very Significant
1	Market Gap	79%
2	Financing Gap	77%
3	Talent Gap	70%
4	Policy Gap	64%
5	Physical Capital Gap	56%

Source: pre-event survey

Market Gap

One of the biggest sources of failure for many technologies intended to serve the BOP has been the lack of market adoption. Respondents to the roundtable pre-event survey ranked this as the most significant barrier to success for invention-based enterprises (see Table 1.) New products, no matter how technologically sound, struggle to gain widespread adoption and use in their intended markets. This problem can stem from a variety of sources depending on the nature of the technology.

Most technologies can be split into one of two categories: demand pull technologies or push technologies. Pull technologies originate with a clearly articulated market demand for a certain technology that does not yet exist; the technology is then created to meet that need. Conversely, push products often originate either out of the expansion of new technological frontiers, or to meet a yet-to-be-perceived need. Either way, the technology, in general, does not have a built-in market.

Even though pull technologies arise to meet an articulated demand of the market, this does not mean that they do not struggle to gain market adoption. Many of these difficulties stem from the fundamental misunderstanding of the market, and the difficulty in field testing and collecting reliable consumer feedback early and often.

Design Disconnect

Participants, particularly in the South Africa roundtable, noted that the vast majority of technologies currently being marketed to the BOP were not designed with the end user in mind. Rather, there was an apparent disconnect between the relatively more wealthy urban inventors and the poorer, often rural, consumer. Consequently, products often do not fit in with local customs, and fail to gain widespread adoption. This is a widely known and researched issue and similar sentiments were echoed in all the roundtables.⁶ However, the question arises: how can the ecosystem better support the development of appropriate, user centered technology?

One potential solution is to support entrepreneurs in the design of more context appropriate products. Several roundtable participants, including IDEO.org and Catapult Design, are at the forefront of a movement that pushes for the application of human centered design (HCD) practices to the context of the BOP market. HCD is a set of processes and techniques used to create new solutions that start with understanding the needs and behaviors of those that are being affected

by the new solutions. These practices have been made freely available in IDEO's Human Centered Design Toolkit. While this process can be extremely helpful to invention-based entrepreneurs, the process of listening to and understanding an intended market's needs and behaviors can be quite expensive and time consuming due to the need to spend significant time with the intended customers, and the need to design and produce several functional prototypes.

In South Africa, The Bertha Centre for Social Innovation and Entrepreneurship at the University Of Cape Town Graduate School Of Business is utilizing an innovative ecosystem level approach in order to create better invention-based products. By partnering with Philippi Village, a new development situated within the heart of a marginalized township on the outskirts of Cape Town, graduate students have the opportunity to enmesh themselves into the communities they aim to serve. By working alongside the local community, students gain a nuanced understanding of the potential consumers' needs, resources, and limitations, and are encouraged to co-create solutions that address real needs.

Customer Feedback

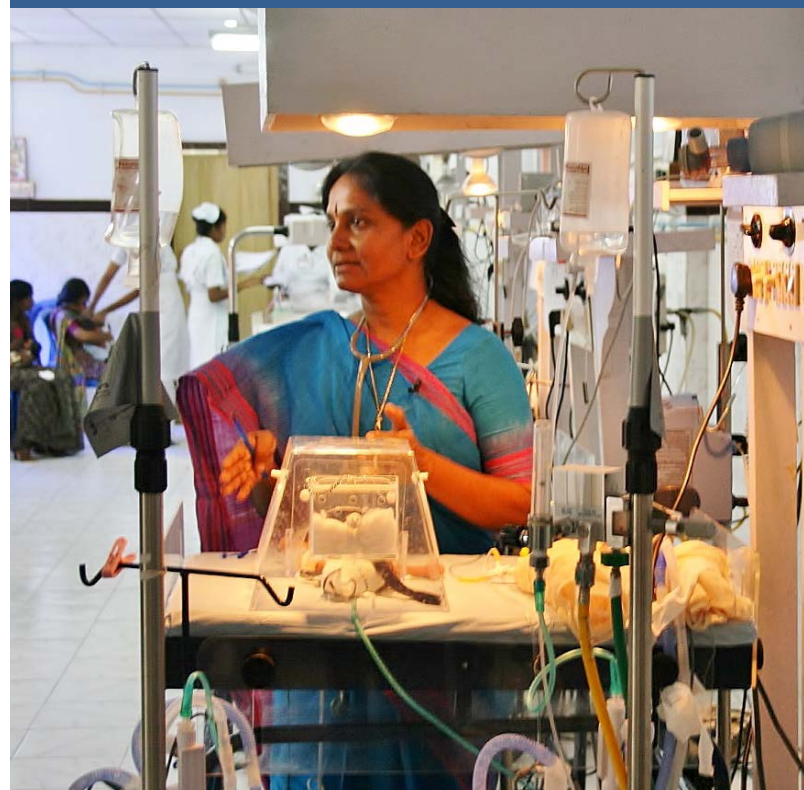
Even when products are designed with the consumers' needs, resources, and limitations in mind, the iterative process of prototyping and market testing is still required. For socially motivated technologies, this feedback is also important in order to articulate the social impact of the technology to funders or to meet impact assessment requirements. However, in BOP markets, this process of collecting accurate feedback can be challenging, time consuming, and costly. In addition to the cost of reaching these often rural or dispersed populations, there are often cultural and linguistic barriers that can interfere with the researcher's ability to accurately gauge the consumer's feedback.

There are many ways that the ecosystem can ease the burden of collecting consumer feedback.

Push versus Pull Technologies

"When marketing beneficial products to consumers, we have found it useful to distinguish pull products, which consumers readily desire and demand, from push products, which they do not. Clearly, push products and the companies that sell them face a tougher challenge in the marketplace and in moving towards scale.

In reality, products lie on a continuum between the extremes of push and pull, since consumers are not a homogenous population in one country or even one city, nor can their desires be characterized as simply present or absent. However, we can say that products exhibit stronger push characteristics when consumers do not recognize the problem the product aims to solve, or are not aware that the product solves that problem, or both...If the consumers are unable to easily assess the benefits or reliability of the product before buying it the challenges in the marketplace escalates." ⁵



For example, David Gluckman a South African invention-based entrepreneur, emphasized the potential of leveraging community level partnerships with civil society organizations as a means to collect accurate consumer feedback.

In addition to community level partnerships, there are a variety of organizations working to develop technology-based solutions to collecting consumer feedback. For example, in India, Villgro is supporting the development of a voiced-based, automated survey tool. This tool will be able to reach consumers on their mobile devices and administer a survey in the consumers' native language. It could then automatically transcribe the consumers' responses. This would eliminate the need to conduct expensive and time consuming field surveys. There are also a number of entrepreneurs attempting to integrate remote sensing technology into their products. By investing in making this sensing technology cheaper and more readily available for all entrepreneurs, the general ability to collect accurate feedback can be increased.

Consumer Financing

An additional challenge to selling invention-based products to the BOP is that, despite every effort to lower the cost of these products, there is still a great chance that the price will be higher than a potential consumer could afford. While

entrepreneurs should work to innovate ways to continue to lower costs, this roundtable series highlighted several ecosystem-level actions that can be taken to provide consumer-side financing for these invention-based products.

For example, in the Kenya roundtable, Sanergy, a low cost urban sanitation company, described its partnership with Kiva. In this agreement, Kiva offered to provide interest-free loans to customers interested in purchasing a Sanergy Toilet and starting their own franchise. Through this partnership, customers were able to overcome the financial barrier to entry without Sanergy having to take on the financing role itself. Sanergy also reported that its partnership with Kiva and its local microfinance institution network helped to lend a degree of credibility to their business.

Market Building for Push Technologies

Push technologies, in general, face all the same problems as pull technologies; however, they face an additional layer of challenges. Because push technologies do not have a built-in market demand, entrepreneurs are often forced to build the market for the new technology. For technologies that seek to create social benefit by solving unperceived problems, awareness around that particular problem also needs to be raised.

Case Study: Global Alliance for Clean Cookstoves (GACC)

Clean cookstoves are a good example of a push technology. In general, customers are unaware of the dangers of indoor air pollutants and thus the value of the product is not apparent. In addition, using these products often involves a significant disruption to the customers established cooking practices. Consequently, clean cookstoves have seen very slow adoption despite their high social value.⁷ The Global Alliance for Clean Cookstoves works to build market demand for these cookstoves both by funding firm-specific marketing campaigns, and by implementing their own sector-wide awareness campaigns.

The Alliance funds firm-specific marketing through its Spark Fund, which provides grant capital to venture and growth stage enterprises. The fund recognizes marketing as a key business need and in the case of Indian biomass cookstove firm Greenway Grameen Infra, nearly half of its Spark grant was spent on marketing and distribution.

GACC also takes an innovative ecosystem-based approach to support these marketing efforts by conducting in-depth consumer segmentation studies that inform entrepreneurs of whom their potential consumers are, and the marketing messages to which they are most likely to respond. GACC also conducts research-based awareness campaigns to raise awareness about the dangers of indoor air pollution in general, and the potential benefits of improved cooking technology. While GACC cannot advocate for any particular technology, they often work with entrepreneurs so that they can coordinate their own marketing campaigns to coincide with the awareness campaign and amplify the impact to the potential consumers.



Financing Gap

Limited access to finance is a well-documented impediment for SGBs in emerging markets. Any entrepreneur, technology based or not, who is pioneering a new and unproven business model, faces tremendous burdens and additional costs associated with the novelty of their model. Rather than simply following in the well-worn and proven track of others, these pioneering entrepreneurs must develop and refine their products and business model through trial and error, develop non-existent supply chains, identify and often train in-country manufacturing partners (if they exist), and build markets for their products and services. All of this adds to the cost and risk of these ventures. Further, these pioneering firms who aim to create social value for the BOP, generally operate on razor thin profit margins. Many investors are unwilling to invest in these ventures due to the high risk, low return nature of these ventures. This difficulty of investing in early stage ventures has been referred to as the “Pioneer Gap.”⁸

Table II: Financing Challenges	
<i>“What do you see as the biggest barriers to financing invention-based entrepreneurs?”</i>	
Finance Challenge	Percent
Inappropriate Financial Instruments	62%
Lack of Exits	51%
Time Frame of Return	43%
Capital Intensity	30%
Lack of Pipeline	28%
Due Diligence	25%
<i>Source: pre-event survey</i>	

This financing challenge is further accentuated when dealing with invention-based enterprises, as the capital intensity is often greater, there is often a longer time horizon until profitability, and investment risk is often much greater. These unique characteristics present a variety of challenges to the full array of potential investors and investment mechanisms. As such, it appears that new collaborative investment strategies are needed to effectively finance invention-based entrepreneurs.

Commercial Investors

Developing new technology-based products is an inherently expensive, time consuming, and risky endeavor both in emerging and developed markets. Even in the United States,

these risks make the financing of early-stage technologies less appealing to commercial investors such as venture capitalists or even finance-first impact investors. These types of investors generally want to see fully developed viable products and proof of revenue. While many developed economies have robust funding mechanisms to bring technologies to this stage, this infrastructure is often not present in emerging markets. Roundtable participants also mentioned that even at the later stages of product development, that commercial investor’s expectations were misaligned with the reality of developing invention based products. Participants claimed that commercial investor capital is often expensive, and many investors are seeking quick returns and easy exits. Roundtable participants claimed that even so-

called “patient capital” was often not patient enough for the timeline, and risks, of invention. For early stage invention-based entrepreneurs in emerging markets serving BOP consumers, these return expectations are not realistic. Furthermore, participants in India mentioned that investing in invention-based enterprises in India is a fairly new field. Consequently there is little history of success to give investors confidence. The confluence of these factors makes it difficult for commercial investors, with their existing financial products, to effectively support invention-based entrepreneurs on their own.

Governments

To overcome this gap, many developed-economy governments have begun extensively funding early-stage development, often channeling it through the university system. The roundtable discussions indicated that, while government funding holds tremendous promise in their local contexts, there were a variety of factors impeding the effective use of these funds.

For example, in Brazil, it was determined that, while the government has a fairly robust support program of university research, incentive structures deter the commercialization of new products. University professors that spin off products and create businesses are seen as “traitors,” because they are sacrificing their academic integrity in pursuit of profits. Consequently, much of this research stagnates within the university system, and new technology-based products are not created.

In South Africa, the government has created the Technology Innovation Agency (TIA), whose core business objective is to support the development and commercialization of competitive technology-based products. However, a degree of frustration with this agency emerged from the roundtable discussion. Participants mentioned that TIA feels much more comfortable

funding initiatives in the public, or university, sector, and in general avoids funding private sector initiatives. When, as one participant noted, more than two-thirds of invention-based entrepreneurs are located outside of the university system, this model becomes problematic.

These examples indicate that, while government funding is adept at supporting university research and development, it is relatively less adept at promoting the creation of businesses to carry the results of this research to market. If government funding is to emerge as a significant enabler of invention-based entrepreneurship, it will have to become more comfortable working directly with the private sector.

Philanthropy

Another potential source of financing for invention-based entrepreneurs is philanthropic grant capital. These roundtables showed that while grant capital can play an important role, it is also critical to understand the risks and limitations of grant capital. In the India roundtable, it was mentioned that, while grants can be used as a stepping stone solution to help fund the early prototyping process, entrepreneurs can lose creativity and efficiency when they have the security of grant capital. Further, in Brazil it was noted that pure grant capital can have a dangerous potential to damage the sustainability of emerging businesses and can potentially distort markets.

Hybrid Financing

While each of these funding mechanisms may struggle to support invention-based entrepreneurship alone, the roundtable series revealed several interesting hybrid models and collaborative partnerships between these types of funders that hold promise for supporting these entrepreneurs.

Yes Bank, an Indian commercial lender, has established partnerships with several philanthropic, grant-making institutions. These philanthropic institutions give grant capital to Yes Bank who then makes extremely low interest rate loans to high-risk seed stage entrepreneurs. This blended model can help to reduce the market distortion risk of pure grant capital, but can also incentivize lending to entrepreneurs who would generally be seen as too risky for commercial investors. While this particular model has promise, it also serves to illustrate the potential effectiveness of collaborative ecosystem-level action. Investors interested in financing invention-based business should further explore these innovative and collaborative financial models.

Another potential ecosystem approach that emerged from these workshops did not involve creating new mechanisms, but mapping existing resources and disseminating the results. In both the India and South Africa roundtables, participants mentioned that there are a large number of government programs, commercial investors, and philanthropic grant-making institutions that aim to serve this segment of entrepreneurship. However, participants believed that many entrepreneurs had a limited level of awareness around these resources. By mapping the available resources, and explaining what types of capital are available at different stages of development, invention-based entrepreneurs may be more likely to find the financing that is right for them.



Talent Gap

Access to talent is an oft-cited barrier to growth for SGBs in emerging markets. For these ventures, hiring and retaining top talent is difficult as the most qualified candidates often prefer to work at more established companies, government jobs, or in an international setting. In fact, many potential investors cite the lack of skilled managers as the primary barrier to placing capital in SGBs.⁹

This talent gap for invention-based enterprises is further complicated by the necessity of a venture to leverage both entrepreneurial skill and technical expertise, two skill sets that are rarely present in a single individual. These unique talent requirements of an invention-based enterprise cause several distinct talent gaps throughout the life cycle of an invention. First, the lack of socially motivated and entrepreneurial engineers in the university system reduces the pipeline of technology with commercialization potential. Second, there is a lack of capacity development support that is targeted at the needs of invention-

based entrepreneurs. Third, invention-based enterprises struggle to recruit and retain qualified local engineering talent.

Creating Entrepreneurial Engineers

Traditional SGBs are usually founded by a business-minded entrepreneur with a developed business model and the necessary skills to run a business. Invention-based enterprises, however, are generally founded by a technically minded engineer with a product or idea for a product, but little entrepreneurial skill or business knowledge. This roundtable series revealed that in many university systems, individual degree programs are largely in silos; consequently, there are limited knowledge spillovers between technical students and business students. Without this type of collaboration, or at least exposure between these types of students, many technically minded individuals lack entrepreneurial aspirations and never attempt to bring their products to market. When and if they do, their lack of entrepreneurial training or business skills can cause them to struggle to package and pitch their ideas as viable business ventures to potential investors. This talent gap limits the potential pipeline of invention-based ideas with commercial potential.

To help bridge this gap, roundtable participants pointed to the need to increase the entrepreneurial training offerings available to students of technical programs in local universities. These participants saw an ecosystem-level solution by building partnerships between these universities and local capacity development organizations. These partnerships would help the universities to design and implement entrepreneurial training, and could help the capacity development providers develop a stronger pipeline of potential clients and a stronger talent pool for their current ventures.

Technical Support for Invention-based Entrepreneurs

For those inventors who do manage to create ventures, there is a somewhat sparse set of

capacity development providers that cater to the unique needs of invention-based entrepreneurs, and a low level of awareness of what resources do exist. While there may be some programs designed to augment the business skill of an invention-based venture, this roundtable series identified a significant gap in the available resources to augment the technical capacity of a venture.

There are several interesting programs, especially in Nairobi, that aim to provide this type of technical support. For example, Fablab at the University of Nairobi has built a partnership with the Massachusetts Institute of Technology to help provide aspiring invention-based entrepreneurs with technical advice and guidance. Gearbox, a forthcoming professional engineering, prototyping and co-working space in Nairobi, also hopes to help address this deficiency of technical guidance by creating a supportive community of inventors to help facilitate knowledge sharing. They also aim to provide a variety of learning resources and access to technical experts to help aspiring inventors to augment their technical skills.

Recruiting, Training, and Retaining Qualified Engineering Talent

While these efforts may help ventures to supplement the quality of their existing talent, the roundtable participants voiced a more systemic problem: invention-based enterprises' inability to recruit and retain qualified engineering talent.

The first barrier to attracting and retaining top talent is an issue of motivation. In both Kenya and India, participants mentioned that the top engineering talent often take jobs in large multinationals or remain in academia. While this may in part be due to the more competitive salaries and job security offered in those sectors, many participants attributed this problem to the lack of role models and success stories to inspire engineers to go into entrepreneurship.

In some roundtable discussions, the idea of

competitions and awards emerged as a potential vehicle to help elevate the place of invention-based entrepreneurship in society and to spread success stories. However other participants noted that perhaps too much emphasis was placed on these competitions; entrepreneurs spent so much time “competing” that they didn’t have the resources to explore long term funding alternatives. In other roundtables, participants explored the possibility of tying financing to the hiring of top talent. In this way the risk of bringing on appropriately compensated engineering talent would be diminished.

For those engineers that do choose to pursue careers in invention-based entrepreneurship, it appears that their skill sets are often misaligned with the needs of these ventures. Roundtable participants in all regions complained that, while the talent coming out of universities was academically successful, they lacked real-world skills or an ability to put knowledge into practice.

In order to better align the skills of university graduates with the needs of invention-based ventures, many roundtables explored the potential of a collaborative ecosystem-level action to form internship and recruiting partnerships between universities and invention-based ventures, perhaps through incubators, accelerators, or peer-to-peer learning. This would address an immediate need by providing additional support to existing ventures, but would also help to train students for future careers with these types of businesses.

Policy Gap

The government policy and regulatory environment can greatly impact all types of entrepreneur’s ability to succeed. However, invention-based entrepreneurs are particularly affected by a range of policy areas due to some of their specific requirements. For example, government research incentives can greatly influence the pipeline of technologies;

commercialization incentives can help draw these technologies out of the labs and into the market; and intellectual property regimes can either help incentivize invention or can present an insurmountable challenge to entrepreneurs. Further, because these businesses are producing physical products, import-export tariffs can also play a major role. In general, this roundtable series found that, while many governments have a suite of policies designed to spur on innovation, they are designed primarily to support larger enterprises and are not designed to support invention-based entrepreneurs.

R&D Incentives

In the South Africa roundtable, participants noted that, while there are some tax incentives for R&D and a considerable sum of government R&D grants available, the process to access these incentives is complicated, inefficient, and slow. For many invention-based entrepreneurs, these barriers prove to be prohibitive.

Due in part to these barriers, universities have emerged as some of the largest recipients of government support. However, as roundtable participants noted, many universities have cultural stigmas associated with commercializing technologies and spinning off businesses. This stigma could effectively be addressed through revised government incentives for the commercialization of university research.

Intellectual Property

The roundtable series found that one of the biggest policy barriers invention-based entrepreneurs face is the difficulty, or perceived difficulty, of obtaining intellectual property (IP) rights for their inventions.

In both the Brazil and South Africa roundtables, participants observed that there were very few registered patents from small businesses and startups. This, participants claimed, was primarily due to the confusing, time-

consuming, and expensive process of filing patent applications and the entrepreneurs' lack of understanding of this system. Participants mentioned that many entrepreneurs lack the legal knowledge to write good patent applications, and many lawyers in certain geographies lack the necessary technical understanding to write accurate patent applications.

This difficulty is generally coupled with a lack of understanding of the importance of intellectual property on the part of the entrepreneur. Roundtable participants cited that many of their patent regimes lack any real enforceability; consequently, the process of patenting can actually expose a technology to duplication.

There are some organizations, such as SiMODiSA in South Africa, that are attempting to close this gap and dispel misconceptions about the value of intellectual property through extensive research and advocacy. In Brazil, the World Intellectual Property Organization (WIPO) is supporting the drafting of patent applications for entrepreneurs and helping entrepreneurs gain access to both the legal and technical expertise they need. South Africa also saw an opportunity for professional service firms to provide pro bono advice to entrepreneurs as a method of fulfilling their government-mandated enterprise development requirements (see Appendix I: South Africa Roundtable for more details).

Helping entrepreneurs to obtain IP protection could be a significant boon to placing capital in these enterprises. According to preliminary research from ANDE's Impact of Entrepreneurship project, ventures owning some intellectual property were significantly more successful in attracting outside equity investment, more likely to have received debt funding, and marginally more likely to have received grant funding.¹⁰

Access to Raw Materials

Government policy can also influence the ability of entrepreneurs to acquire the raw materials

they need to build their products. In the Kenya roundtable, participants mentioned that the import duty regime in Kenya was structured so that importing raw materials is often much more expensive than importing finished products. This, participants argued, was one of the primary reasons why many companies choose to manufacture their goods outside of the country and import finished products. While this strategy may be viable for established, large companies, for startups that must rapidly iterate new product designs and are often too small to take advantage of the economies of scale offered abroad, this strategy is rarely feasible.

This is one manifestation of what some participants referred to as a skewed roadmap for national development that focuses on foreign interest and investment rather than building local capacity for industrial growth. Participants also cited that, in the few instances where local industrial growth is prioritized, those large businesses dominate and small businesses and entrepreneurship are often crowded out. For example, Kenya has several special economic zones, in which businesses are exempt from certain taxes and levies. While participants in general thought these were successful in promoting domestic manufacturing, they were in general not open to small entrepreneurial businesses.

Furthermore, roundtable participants determined that small invention-based enterprises have little to no resources available to help them lobby policy makers or advocate for a more supportive policy environment.

While the particular necessary policy interventions differ from country to country, there is clear potential for ecosystem-level action. By forming more cohesive relationships between invention-based entrepreneurs and by building industry associations, the collective capacity of this segment to influence policy and create a supportive policy environment for invention will increase.

Physical Infrastructure Gap

Turning an idea into a commercially viable product requires several stages of prototyping and iteration. In emerging markets, this process of prototyping can prove to be extremely expensive and time-consuming, as the physical equipment and raw materials needed to create these prototypes are not available locally. Consequently, invention-based entrepreneurs are often forced to produce their prototypes abroad. This practice can add significantly to the time horizon of an invention-based enterprise, and thus decreases the attractiveness of invention-based enterprises to potential investors.

Table III: Prototyping Space

“On average, where do invention-based entrepreneurs conduct the majority of their prototyping work?”

Prototyping Space	Percent
Own Space	62%
University Lab	37%
Incubator / Accelerator	31%
Company Lab (formal)	10%
Service Provider	9%
Company Lab (informal)	7%
Maker Space	7%

Source: pre-event survey

Facing this lack of locally available physical capital, some entrepreneurs have sought to vertically integrate themselves by acquiring the required equipment and establishing their own supply chains to source the required materials. For invention-based enterprises, where capital intensity is already an issue, this necessity to vertically integrate can further exacerbate this capital intensity and serves as a significant impediment to more investments being made into the industry. Unfortunately, according to the survey results, it appears that a majority of entrepreneurs are forced to conduct prototyping in their own workshops.

This roundtable series revealed that a great deal of the required prototyping equipment is actually present in major urban areas such as Nairobi, Delhi, and Cape Town. However, this equipment is generally located in government

labs, university workshops, or in the workshops of larger corporations. These workshops are in general closed to the public, and are resistant to allowing entrepreneurs to use their equipment. Furthermore, this industrial equipment tends to be clustered within certain urban areas. For many entrepreneurs who are not based in the same immediate area, this equipment is completely inaccessible. In this roundtable series, many anecdotes emerged of entrepreneurs who, through informal relationships with friends or family, were able to gain access to this equipment. When they did, it seemed to greatly condense the product development cycle and reduce costs.

In India, participants thought that government policy could play an important role in incentivizing corporations and universities to allow entrepreneurs limited access to

prototyping equipment. And in Kenya, the potential of public-private partnerships, as well as resource mapping was explored. However, for the time being it seems that creating open access to this needed prototyping equipment at a scale large enough to have ecosystem-level impact is not yet viable.

A number of entrepreneurs around the world have begun to explore the possibility of a collaborative, ecosystem-level approach to providing locally available physical capital. The most notable of these are Fablab and Gearbox, both centered in Nairobi. These efforts aim to replicate makerspaces, such as the popular

US-based TechShop, and seek to establish physical centers where entrepreneurs can, for a membership fee, access prototyping equipment, co-working space, advice and mentorship, and a network of like-minded invention-based entrepreneurs. Centrally locating and providing easy access to this prototyping equipment would reduce the time and money entrepreneurs need to invest to access equipment. While it is too early to determine the full impact of these efforts, they have caught the attention of the global invention community, and participants in all roundtables voiced an interest in creating similar entities in their own countries.

Case Study: Sanergy - Gearbox

Sanergy is an invention-based enterprise working to build innovative toilets for poor urban areas in Kenya. When Sanergy started out, they were committed to building their products domestically. However, during their attempt to redesign their FreshLyfe Toilet, prototyping locally proved to be enormously challenging. Sanergy struggled to gain access to some of the most basic tools and equipment, and even struggled to find basic materials like clay to build molds.

“Many of the large companies or universities in Nairobi had this equipment but they had no interest in working with us,” says David Auerbach, Co-founder of Sanergy. “We were simply too small. Even if they did have an interest, they don’t think like businesses and operate on much slower timelines. This would not have been a good fit for a small startup like ourselves “

Consequently Sanergy relocated its product development operation to Seattle, in the United States. While this made the building of prototypes much easier, it too proved problematic as the cost, and time frame of testing and modifying these prototypes, increased. “If you have a prototype in Seattle, you have to pay to ship it to Kenya to test it. You then find out something small needs to be modified and have to ship it all the way back to Seattle again. This process becomes inefficient very quickly and takes a lot of time and effort,” says David. “Our story is by no means unique, and these inefficiencies multiply quickly when you’re looking at this industry as a whole.”

To overcome these challenges, many of the people involved in Sanergy began building a plan for Gearbox. Gearbox will build off of the makerspace model in the United States and will provide entrepreneurs with access to a range of tools and equipment to help them build prototypes. Beyond creating access to equipment, Gearbox aims to provide a space for invention-based entrepreneurs to come together and share their knowledge with each other.



Conclusions and Collaborative Solutions

While a breakdown of the specific challenges identified in this roundtable series can be found in the Table IV, several salient overarching trends emerged from this global series of roundtables.

Map the ecosystem.

It became apparent through these roundtable discussions that there was a low level of overall awareness about who was doing what to support invention-based entrepreneurs, and how to engage or participate in these activities. By better mapping and disseminating knowledge regarding who is actively working to support invention, entrepreneurs will be better able to navigate to the resources they need to grow.

Create a community.

It seemed that the most apparent and cost-effective solutions to many of the challenges brought up in these roundtables involved better inter-sectorial collaboration. For example, vertical collaboration among different classes of funders can help create viable financial products to finance invention-based entrepreneurship. In addition horizontal collaborations between different types of ecosystem actors such as universities, corporations and capacity development providers can help to provide physical capital to invention-based entrepreneurs.

In most cases it seems that increased collaboration has great potential to bridge the limitations of any single actor, and create more holistic solutions that have the potential to not just support invention-based entrepreneurs on a one-off basis, but to create a more vibrant ecosystem.

A more cohesive community also has a benefit in its ability to create knowledge spillovers. In many instances, other entrepreneurs may be able to provide the most useful support to one another. By building this more cohesive community, the ecosystem can facilitate a greater degree of peer-to-peer learning.

It is important to recognize that, despite the potential of collaborations to generally create mutual benefit, to date, these partnerships have been slow to emerge. While roundtable discussions like this can play an important first step in creating a trusting and collaborative community, further incentives may be needed to spur on greater collaboration in the ecosystem.

Universities need to be more entrepreneurial; the ecosystem needs to help.

This roundtable series revealed that invention-based entrepreneurs intersect with universities in a number of ways. Universities can supply a pipeline of technology with commercial potential; they can provide access to well-equipped labs and workshops; they can educate and prepare the pool of potential employees; they can more easily tap into government funding; and they can supply an inexpensive source of market intelligence. Despite all of this potential for universities to support invention-based entrepreneurship, it seems that, in large part, universities are disengaged from this ecosystem.

For the ecosystem to flourish, universities will have to become more active supporters of entrepreneurship. While many universities are beginning to engage, there are ample opportunities for various ecosystem actors to facilitate this transition and partner with the university system in order to take advantage of this largely untapped potential.

Corporate partnerships can benefit all involved, but the value proposition needs to be made clearer.

Like universities, corporations have great potential to positively contribute toward building a stronger ecosystem for invention-based entrepreneurs. For example, they can purchase and import raw materials at lower cost, they can provide access to equipment and tools, they can provide expert technical advice and mentorship, and they can help create access to downstream distribution channels. While some corporations may engage in these activities to fulfill corporate social responsibility requirements, they in general cannot be expected to contribute for purely philanthropic reasons. Rather, the value proposition of engaging with and supporting invention-based entrepreneurs must be made clearer. To date, it appears that the small-scale and one-off nature of many invention-based entrepreneurs prevents potential corporate partnerships from being large enough to be interesting to corporate actors. However if partnerships, can be formed at the ecosystem level—between intermediaries such as investors, or incubators—larger deals may emerge that are large enough to interest corporate partners

Closing ecosystem gaps will help unlock financing.

We believe that what participants have voiced as a financing gap is actually in large part a manifestation of the four other gaps. The difficulty in placing capital in invention-based enterprises stems primarily from some of the unique challenges they face. By addressing these challenges at their root through ecosystem strengthening, these unique challenges can be alleviated. Thus while new financial instruments should be developed in the interim, strengthening the rest of the ecosystem may be the most effective long-term solution to unlocking capital. For example:

- Closing the physical capital gap will reduce the cost and timeframe of prototyping, making it easier for entrepreneurs to demonstrate proof of concept and attract funding.
- Closing the market gap will reduce the cost of testing and building market demand for a product, and will allow entrepreneurs to communicate proof of demand to the investor.
- Closing the talent gap will increase the quality of the technology and the investment readiness of enterprises. It will also increase the number of potentially investable ideas making it potentially more attractive for investors to develop specialized products for invention-based entrepreneurship.
- Closing the policy gap will enhance the enabling environment, and make it easier to overcome all of the other barriers.

Table IV: Summary of Ecosystem Gaps

Ecosystem Gap	Specific Challenges	Current Approaches	Potential Areas of Activity
Market Gap	<ul style="list-style-type: none"> • Designing appropriate technology • Collecting consumer feedback • Consumer side financing • Market building for push technology 	<ul style="list-style-type: none"> • Human centered design • Consumer financing through partnerships • Industry level marketing for push products 	<ul style="list-style-type: none"> • Leveraging partnerships to understand consumer need and feedback • Investing in technology for efficient feedback
Finance Gap	<ul style="list-style-type: none"> • Inappropriate mechanisms • Failure to coordinate capital • Lack of awareness of existing resources 	<ul style="list-style-type: none"> • Partnerships between philanthropy and commercial investors 	<ul style="list-style-type: none"> • Mapping and dissemination of potential funders • Collaborative funding
Talent Gap	<ul style="list-style-type: none"> • Creating entrepreneurial engineers • University cultural misalignment • Lack of technical support services • Lack of skilled workforce 	<ul style="list-style-type: none"> • Collaborative approaches to providing access to technical experts and advice 	<ul style="list-style-type: none"> • Partnerships to increase entrepreneurial training at universities • Expanded internship and recruitment programs
Policy Gap	<ul style="list-style-type: none"> • Lack of R&D incentives • Lack of commercialization incentives • Limited understanding of IP rights • Import export tariffs 	<ul style="list-style-type: none"> • Third party, pro bono support of IP acquisition 	<ul style="list-style-type: none"> • Better mapping and education on existing government programs • Partnerships with corporations to acquire raw materials • Industry associations to advocate for supportive policy
Physical Capital Gap	<ul style="list-style-type: none"> • Lack of access to prototyping space • Lack of knowledge about existing resources 	<ul style="list-style-type: none"> • Maker spaces and co-working space • Informal partnerships 	<ul style="list-style-type: none"> • Incentivizing access to corporate and university equipment • Better mapping and dissemination of existing resources • Refining the makerspace model

Appendix I: Country Profiles

South Africa Summary of Discussion

The South African roundtable was hosted at the Bertha Centre for Social Innovation and Entrepreneurship at the University of Cape Town Graduate School of Business. The roundtable attracted a diverse group of stakeholders to discuss the state of the invention-based enterprise ecosystem, as well as to identify the gaps in this ecosystem, and potential areas of collaboration to strengthen it. Participants included ANDE members such as the Bertha Centre for Social Innovation and Entrepreneurship, Impact Amplifier, and Nesa Capital. Non-members representing academia, incubators, research institutions, IP law firms, associations, government funding agencies and entrepreneurs were also in attendance. Topics included access to finance and infrastructure, the regulatory environment, and the roadmap that entrepreneurs face moving from idea to product. Participants shared that in general funders are risk averse in South Africa, and that even when money is available, entrepreneurs and inventors are not aware of it. Participants felt that there is a network failure in the ecosystem, and players need to better collaborate and document available support. Physical capital for prototyping is available in urban centers, but it is not always accessible to poorer inventors. In addition, wealthier inventors often invent products that are not demand-driven because there is a lack of knowledge about what end user communities need. Some valuable ideas for future collaborative action were produced by the group, such as building on an existing technological platform to map the ecosystem and forming a collaborative platform to leverage existing resources of various players.

Topic 1: Finance

Participants cited that investors are too risk averse in South Africa. Seed funding and soft development capital is needed. Venture capital is expensive, and there appears to be more money available for information technology products than for physical products. Government funding agencies are also considered risk averse. Participants claimed that access to funding is slow and favors universities over the private sector. This prevents the majority of small-scale inventors, who are unaffiliated with academic institutions or sophisticated technology transfer offices, from receiving government funding. Participants also expressed frustration with the Technology Innovation Agency (TIA), citing instability and the disappearance of its seed fund. TIA's Saberi Marais agreed TIA is not spending money rigorously enough, but current strategic changes aim to bring about improvements. One entrepreneur, David Gluckman of Khusela, shared that while he was initially unaware of the agency, once he did engage he had a positive experience with TIA. In a similar vein, participants shared that private sector money and "bridge funding" in the form of loans for more established SGBs exist but are often unknown. There is also a need for stronger public/private partnerships. Enterprise Development (ED)¹¹ money, a government incentive scheme that should encourage corporates to invest in risky ventures, is risk adverse and favors quick job creation or financial outcomes. Several entrepreneurs in attendance expressed frustration with the Small Enterprise Development Agency (SEDA), saying the criteria for support are too strict. These challenges to accessing finance present an opportunity for the creation of informal angel networks and a collaborative platform or map of the ecosystem to document available sources of funding. In addition, the group recommended that a 'Risk Capital Enterprise Development Fund' could be created for testing and prototyping.

Topic 2: Physical Infrastructure

Participants shared that there is not necessarily a lack of physical infrastructure in South Africa, but a lack of access. There are places such as the Innovation Hub and TIA Technology Stations, but they are not easily accessible to township entrepreneurs, who often have good ideas for addressing community issues. In the Western Cape there is a relatively greater amount of support for ICT, but less for manufacturing and complex technologies. For such inventions, access to universities is needed. Several entrepreneurs mentioned that they have considered moving abroad in order to gain better access to this physical infrastructure.

Topic 3: Markets Access – IP and the Regulatory Environment

There appears to be a large misconception around intellectual property (IP), and the costs, benefits, and requirements of obtaining IP. Professional services are expensive; consequently, few SGBs seek out or register for patents. In addition, grant processes and government R&D tax incentives are difficult to access. SiMODiSA, a consortium that is collaborating on research and lobbying for policy changes, is attempting to close the IP education gap. Their research found misconceptions around laws and implementation. More such public engagement is needed. Opportunities also exist for the industry to lower costs in the form of tax breaks for venture capitalists. Professional services firms should also be encouraged to use Enterprise Development points to give pro bono advice. Further, “pay for success fees” and other innovative models should be researched.

Topic 4: Markets for Invention – Impactful Invention and BOP Distribution

There is a polarization between traditional middle-class inventors and the poorer markets they are trying to serve. Consequently new products are not always demand driven. The Institute of Inventors and Innovators (III) reported that they often see high quality ideas from the townships, but a culture of innovation needs to be fostered and the perception of risk quelled in order for these ideas to be put into action. This can be accomplished in part by creating more support structures. Access to professional services such as mentorship, accountants and IP experts is lacking. Further, basic township infrastructure issues remain, such as access to the internet and electricity. This suggests the need for community partnerships to address market needs. This roundtable identified several interesting approaches. For example, the Bertha Centre has a partnership with Philippi Village, in which graduate students work in the community to devise relevant solutions. Khusela enlisted the help of civil society to gain market understanding and community trust. The Awethu project in Gauteng incubates entrepreneurs from under-resourced communities. Impact Amplifier is involved with setting up rural and peri-urban micro franchise asset finance fund vehicles, and is working to make food value chains more socially inclusive to smallholder farmers and microprocessors. The Research Institute for Innovation and Sustainability (RIIS) has two rural solution exchanges that give entrepreneurs greater international visibility. Despite the work of these enablers, the sense is that greater inclusivity is needed.

Topic 5: From Idea to Product – Bridging the Invention Gap

Difficulty surrounds the translation of ideas to market, as inventors are often not entrepreneurs and lack basic business skills. There is thus an ecosystem failure due to a lack of coherence between players and a clear understanding of roles. Ludwick Marishane emphasized the need for access to the right support. Participants also stressed that a fear of failure is prevalent, and highlighted the need for ‘quick fail market tests’ and rapid prototyping. Antonel Olckers highlighted the benefits

of entrepreneur-to-entrepreneur learning. It was also agreed that successful South African entrepreneurs need to be showcased to inspire talent. Debate around business competitions arose, as some said investors spend too much on prize money and too little on helping entrepreneurs start a company. However, other participants said that exposure to funders and peer-to-peer learning was valuable. Overall, the value of the network is essential and collaborative opportunities exist to develop a “roadmap from idea to product” that defines support roles of ecosystem players.

Table V: Participating Organizations at South Africa Roundtable
Azargen
Council for Scientific and Industrial Research, CSIR
DNABiotec
Good Neighborhoods Foundation
Headboy Industries
Impact Amplifier
Innovus
Institute for Inventors and Innovators
Khusela
Nesa Capital
SiMODiSA
South African Institute for Entrepreneurship (SAIE)
Spoor.Fisher
Technology Innovation Agency
The Innovation Hub
The Research Institute for Innovation and Sustainability
The ResilientAfrica Network
The Silicon Cape Initiative
University of Cape Town

Kenya Roundtable: Summary of Discussion

The Kenya roundtable brought together 37 participants including invention-based entrepreneurs, investors, capacity development service providers, corporations, academia and government. The meeting focused on improving the ecosystem for invention-based enterprises and addressed the following key issues:

- The need for physical infrastructure to facilitate invention
- Challenges and opportunities of accessing BOP markets
- Talent gaps in the invention-based enterprises ecosystem and how they can be addressed

Participants reviewed the invention journey and participants identified the resources available to inventors at each stage. The need for more makerspaces was identified and participants learnt about the current initiatives to create more robust makerspaces to support local inventors. The meeting also looked at how inventors access markets.

The invention-based enterprises ecosystem has grown significantly in recent years with the establishment of makerspaces like the Fablab at the University of Nairobi, a growing number of investors and business service providers, and a growing community of inventors. There is still a significant physical capital gap in both availability of such facilities and the accessibility of the existing facilities. There is also a strongly felt need for lobbying and advocacy that is more supportive of SGBs in the sector as most current efforts are focused on larger companies. The biggest opportunities identified include partnerships, especially between the public and private sectors to create a pipeline of commercially viable inventions and promote learning for inventors.

Topic 1: Physical Capital

There are facilities currently available through the public sector (e.g. Kenya Industrial Estates and Numerical Machining Complex) or universities, but few of these are accessible to the public and SGBs that require rapid prototyping and testing facilities. An upcoming commercial makerspace, Gearbox, seeks to address this need.

Opportunities for growth exist through public-private partnerships to ease the procurement process for materials and machinery. Another opportunity exists for collaboration between corporations with R&D facilities and small and growing invention-based enterprises.

Topic 2: Access to Public Sector/Regulated Markets

Taxes and levies on importing raw materials or capital inputs and prohibitive tender application processes are the biggest barriers to entry for invention-based enterprises. There is also a general lack of knowledge and understanding about the legal environment that governs public procurement. Small and growing invention-based enterprises also lack adequate representation in advocacy bodies, making it difficult for their needs to be addressed. Opportunities for improvement include expansion of current public initiatives (e.g. the Special Economic Zones) to include small businesses, and advocacy to increase attention on SGB interests in areas such as public procurement. India was identified as a model to emulate in public policy reform targeting small and growing invention-based enterprises.

Topic 3: Access to BOP Markets

Sanergy is a sanitation company that uses a franchise model to make clean sanitation facilities accessible to residents of Mukuru Slum. Using Sanergy as a case, the roundtable identified product acceptance, market spoilage, and financing as the major challenges in accessing BOP markets. While the specific challenges vary from product to product and region to region, human-centered design was identified as a useful tool in developing products likely to gain acceptance while partnerships with non-profits and financiers (e.g. Kiva) enabled Sanergy to avoid market spoilage and enable franchisees to access financing to buy into the franchise.

Topic 4: Talent Gap

There were talent gaps identified at every stage of the invention pipeline; there is a lack of business and entrepreneurial skills for inventors, as well as technical and industrial design skills. The roundtable came up with a number of initiatives that could help stem these gaps, such as introducing business learning tools into technical programs at universities and in makerspaces (as Gearbox plans to do) and partnering universities with private companies where engineering students could

gain hands-on experience. Another approach is to set up competitions and exhibitions that would expose viable inventions to investors and capacity builders.

Table VI: Participating Organizations at Kenya Roundtable
Acumen
FabLab- University of Nairobi
GOAL
GreenEdge Digital Africa
GRM International
GrowthAfrica
I-DEV International
IDEO.org
iHub
Intellectap
Kenya Feed the Future Innovation Engine
KickStart
Ministry of Industrialization and Enterprise Development
Open Capital Advisors
Philips
PUM Netherlands Senior Experts
Sanergy
Strathmore University
Sustainable Development for All
TLcom (TIDE Foundation)
U.S. Agency for International Development
Villgro Innovations Foundation

Brazil Roundtable: Summary of Discussion

The Roundtable on Strengthening the Ecosystem for Invention-Based Enterprise in Sao Paulo, Brazil. In addition to ANDE and The Lemelson Foundation, this roundtable was made possible by the generous support of World Transforming Technologies (WTT), an organization focused on supporting innovative solutions that can generate social impact in local communities. There were 40 participants, including leaders of the biggest innovation centers in the country, academia, accelerators, investors, corporations, and entrepreneurs.

Topics of discussion included: instruments for investing in early stage invention, strategies for sourcing pipeline, methods of supporting prototyping and incubation, barriers to obtaining intellectual property rights, and tools to help develop talent in the university system. Relevant actors from the ecosystem included, CESAR, Fundação CERTI, WIPO, Thomson-Reuters, ANPEI.

Topic 1: Finance Gap

Investment was one of the main topics of discussion during the roundtable. Participants pointed out

that new instruments for investing in invention-based entrepreneurs are necessary. In particular, they highlighted that there is a lack of investment in the prototyping stage of development.

Funding for early-stage product development and prototyping in Brazil is scarce. What little funding is available is primarily concentrated in the university system, with few external investors interested in taking on the associated risks. While this university system is rather adept at developing these technologies and acquiring IP rights for the technology, they are generally not interested in taking these technologies to market. Commercial investors, on the other hand, who may be interested in supporting the commercialization of these products, are deterred by the prohibitively high cost of acquiring the IP rights from the universities. Consequently a “valley of death” emerges that prevents the scaling of these products. Participants mentioned mechanisms such as National Bank of Social and Economic Development (BNDES), FINEP (National Agency for Research and Innovation), National Service of Industrial Learning (SENAI), National Service to Support Micro and Small Businesses (SEBRAE), SEBRAEtec (SEBRAE’s program for innovation and technology) as potential good options to scale and prototype business.

Topic 2: Entrepreneurial Environment

Potential inventors in Brazilian universities do not have sufficient incentives to commercialize the products of their research, become entrepreneurs, and leave the university system. Often, university incubator programs have agreements that favor the university rather than the entrepreneur; consequently, inventors are discouraged from engaging in entrepreneurship. There is also a lack of incubators and technology centers outside of the university system for invention-based entrepreneurs, making it more difficult to take potential technologies to market.

Participants also mentioned the patent challenge in the country as a major barrier to growth. There is very little incentive for patenting in Brazil because the legislation is confusing, the process is slow, and the patents themselves are not helpful in leading to profitability. Furthermore, to write good patents there is a need to combine technical and legal knowledge. This is a big problem in Brazil, since most of the time lawyers with no technical skills are the ones responsible for writing patents. Investing in trainings and changing some public policies could be a great option for this issue.

Topic 3: Talent Development

A major challenge identified by participants was the lack of qualified human resources, especially in hardware development. They claimed that this stems primarily from a problem in the educational structure, particularly in elementary and high school. The lack of training at these lower levels forces engineering universities to spend an inordinate amount of time teaching basic technical skills. Consequently, graduates of these engineering universities do not have the needed skills to contribute to an invention-based enterprise.

In some regions, such as Pernambuco, public schools are implementing robotics labs to be universalized in elementary and secondary education to create interest and knowledge in children about invention. All participants recognized that stimulating this interest at childhood would help create more highly skilled engineers.

Another challenge identified by the participants was the lack of mentorship and guidance for students with entrepreneurial aspirations. Participants claimed that in the university system

teachers do not stimulate or promote innovation and entrepreneurship in their students. Today, if a professor creates or supports the emergence of a startup within the university, it will not be viewed positively by his or her academic peers, and it will not be financially rewarded by the university. Participants agreed that incentives need to be created to inspire more innovation in the university system.

Table VII: Participating Organizations at Brazil Roundtable
ANPEI
Arbela Investimentos
Ashoka
Brazil Innovators
CESAR
Fundação CERTI
Fundação Getulio Vargas
Fundação Telefônica
GAG Investimentos
ICE (Entrepreneurial Citizenship Institute)
Instituto Alana
Instituto Arapyau
NESsT
Nestlé S.A.
New Earth Nation
OIC - Observatório da Inovação e Competitividade
Quintessa
SENAI SP
Thomson Reuters Foundation
Universidade Estadual Paulista
University of Sao Paulo
Valor Capital
Vox Capital
WIPO
World Transforming Technologies

India Roundtable: Summary of Discussion

The consultation on strengthening the Indian ecosystem for invention-based enterprises was held in New Delhi, bringing together 40 stakeholders from across the ecosystem. One entrepreneur stated this was the first ever non-ICT product convening that he had ever attended.

The day long events aimed to identify opportunities to strengthen the ecosystem for invention-based enterprises, and develop ideas and collaborations centered on finance, talent and physical infrastructure challenges. ANDE members such as Villgro, UnLtd India, CIIE, and Intellect were key partners in developing the event and were joined by other organizations such as SELCO, Changeworx, Sangam, and public sector organizations such as Venture Centre (a National Chemical

Laboratory and Department of Biotechnology initiative).

Most participants agreed that policy action was necessary for any major change in the ecosystem. Government funding and resources like prototyping labs were connected to premier institutes like the Indian Institutes of Technology and were not accessible to those entrepreneurs who were not connected to these institutions. Initiatives that push for policy change to mandate co-sharing of these labs and incentivizing universities to commercialize inventions would be challenging, but will lead to beneficial outcomes.

Participants also recognized existing opportunities for collaboration and sharing to significantly strengthen the ecosystem. This includes mapping the existing network of stakeholders engaged with invention based enterprises, more effective information sharing for invention based entrepreneurs to access existing funds and resources, and creating opportunities to educate investors about this space. Lack of any demonstrable exits in this space was seen as a major barrier.

Topic 1: Talent

Participants agreed that the talent challenges range from building the capacity of the entrepreneur (managerial training) to supporting the growth of enterprises with talent that is 'start-up ready'. Participants cited that good talent with the capacity to make an impact on their company for invention based enterprises is equivalent to .01% of the available talent pool. Developing internship platforms, getting young people involved in start-ups through open houses, and creating role models that inspire young people were some of the suggested strategies.

This needs to be accompanied by building the hiring skills of start-ups, opening up a broader conversation of building the capacity of the founders and the management team. It was felt that co-sharing spaces offer an opportunity for peer learning. In the context of invention-based enterprises, there is a need to build the capacity of the inventor with technical and technological assistance, as well as business guidance from board members and mentors.

Topic 2: Access to Finance

A major challenge facing the ecosystem in India is a serious lack of investments and exits. The participants agreed that this lack of exits was a part of the reason that investors lack appetite for invention based enterprises. Educating investors about the business case and improving their technical ability to evaluate invention based enterprises would be helpful in this context. Participants suggested that ANDE could manage a database of people who are experts in assessing invention based products. However this also needs to be matched by making invention based enterprises invention ready.

In absence of private sector investing, government programs have played a significant role through grants for entrepreneurs, though there is a lack of information and awareness about them. More efficient knowledge sharing would open up access to government resources. This enthusiasm for grant capital was accompanied by the concern that grant capital can kill the entrepreneur's creativity. Yes Bank's model of leveraging grant capital to give out low interest rate loans was held as a good example for emulation with the caveat that debt capital for the social impact sector has yet to achieve success.

Topic 3: Access to Infrastructure

Lack of access to existing prototyping infrastructure was seen as a major challenge for the ecosystem. Most of the existing infrastructure is in premier universities or government research institutions and is not accessible. There are no co-sharing facilities and access to these spaces is only possible through a formal network with these institutions or a personal connection.

This was a bottle neck that participants felt policy can successfully tackle by mandating co-sharing of institutional infrastructure, creating incentive for research institutions to open up labs, and rewarding universities for facilitating entrepreneur growth.

Cluster based programs and tool rooms such as a very successful Indo-German tool room in Aurangabad were some of the rare success stories along with the Venture Centre model for bio-technology industry as supported by Government of India's BIRAC with access to infrastructure in conjunction with finance and training.

Participants suggested that creating and disseminating a database of available resources and case studies of success stories would be helpful for policy action and for other institutions to emulate. Incubators also need to enter this sector and provide more technical assistance. Most incubators at this time prefer to focus on the business skills aspect.

Table VIII: Participating Organizations at the India Roundtable
Aravali Scholars, TiE Delhi-NCR
Asha Impact
Aspen Institute
Aspiring Innovedi
Biosense
Centre for Knowledge Societies
Changeworx
CIIE at IIM-A
Ennovent
IDOBRO
InnAccel
Intellectap
Karmany
KITCO
NCL Venture Center
NEN
New Leaf Dynamic Technologies
Okapi
PATH
Sangam
Selco Foundation
Small Scale Sustainable Infrastructure Development Fund
UnLtd India

USAID

Villgro

Wadhvani Foundation

Endnotes

- 1 OECD. SMEs Entrepreneurship and Innovation. Paris: OECD, 2010.
- 2 OECD 2010
- 3 For more information on ANDE's diagnostic framework, or any of the other frameworks, please visit <http://www.aspeninstitute.org/publications/entrepreneurial-ecosystem-diagnostic-toolkit>
- 4 Please see <http://www.aspeninstitute.org/sites/default/files/content/upload/Engineering%20Social%20Innovation%20-%20Workshop%20Summary%20%281%29.pdf> for a full summary of the Santa Clara Roundtable.
- 5 Koh, Harvey, Nidhi Hedge, and Ashish Karamchandani. Beyond the Pioneer. Monitor Inclusive Markets, 2014.
- 6 IDEO. "Human Centered Design Toolkit." IDEO.com. n.d. <http://www.ideo.com/work/human-centered-design-toolkit/> (accessed October 15, 2013).
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- 8 Koh, Harvey, Karamchandani, Ashish, Katz, Robert. From Blueprint to Scale. Monitor Group , 2012.
- 9 Monitor Deloitte. Growth and Opportunity: The Landscape of Organizations that Support Small and Growing Businesses in the Developing World. Working Paper , Washington, DC: Aspen Network of Development Entrepreneurs, 2013.
- 10 Roberts, Peter, Sean Peters, and Saurabh Lall. The Impact of Entrepreneurship Database Program 2014 Mid-Year Data Summary. Atlanta: Social Enterprise @ Goizueta, http://www.aspeninstitute.org/sites/default/files/content/docs/pubs/2014_Mid_Summary_Final_Emory_ANDE.pdf, 2014.
- 11 Enterprise Development (ED) is one of the seven elements contained within the South African Black Economic Empowerment scorecard. Enterprise Development contributions consist of monetary and non-monetary, recoverable and non-recoverable contributions actually initiated in favor of a beneficiary entity by a measured entity with the specific objective of assisting or accelerating the development, sustainability and ultimate financial independence of the beneficiary. This is commonly accomplished through the expansion of a beneficiaries financial and/ or operation capacity." (www.enterprisedevelopment.co.za).



About the Aspen Network of Development Entrepreneurs

The Aspen Network of Development Entrepreneurs (ANDE) is a global network of organizations that propel entrepreneurship in emerging markets. ANDE members provide critical financial, educational, and business support services to small and growing businesses (SGBs) based on the conviction that SGBs will create jobs, stimulate long-term economic growth, and produce environmental and social benefits. Ultimately, we believe that SGBs can help lift countries out of poverty. ANDE is part of the Aspen Institute, an educational and policy studies organization. Members of ANDE include both for and nonprofit investment funds, capacity development providers, research and academic institutions, development finance institutions and corporations from around the world. Launched with 34 members in 2009, ANDE now comprises over 220 members who collectively operate in more than 150 countries.

About The Lemelson Foundation

The Lemelson Foundation uses the power of invention to improve lives, by inspiring and enabling the next generation of inventors and enterprises to promote economic growth in the US, and social and economic progress for the poor in developing countries. Established by prolific US inventor Jerome Lemelson and his wife Dorothy in 1992, and lead by the Lemelson family, to date the Foundation has provided or committed more than \$175 million in grants and Program-Related Investments in support of its mission. In developing countries, the Foundation works with partner organizations to support inventors and entrepreneurs building businesses that address the problems of the poorest populations through the creation of products that address basic human needs, like access to food or water, or create jobs or increase incomes of the poor. Within this context, the Foundation works with partners to establish and support programs that inspire youth to become inventors, stimulate and provide invention and entrepreneurship education, and support the launch, early incubation and mentoring of enterprises.



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