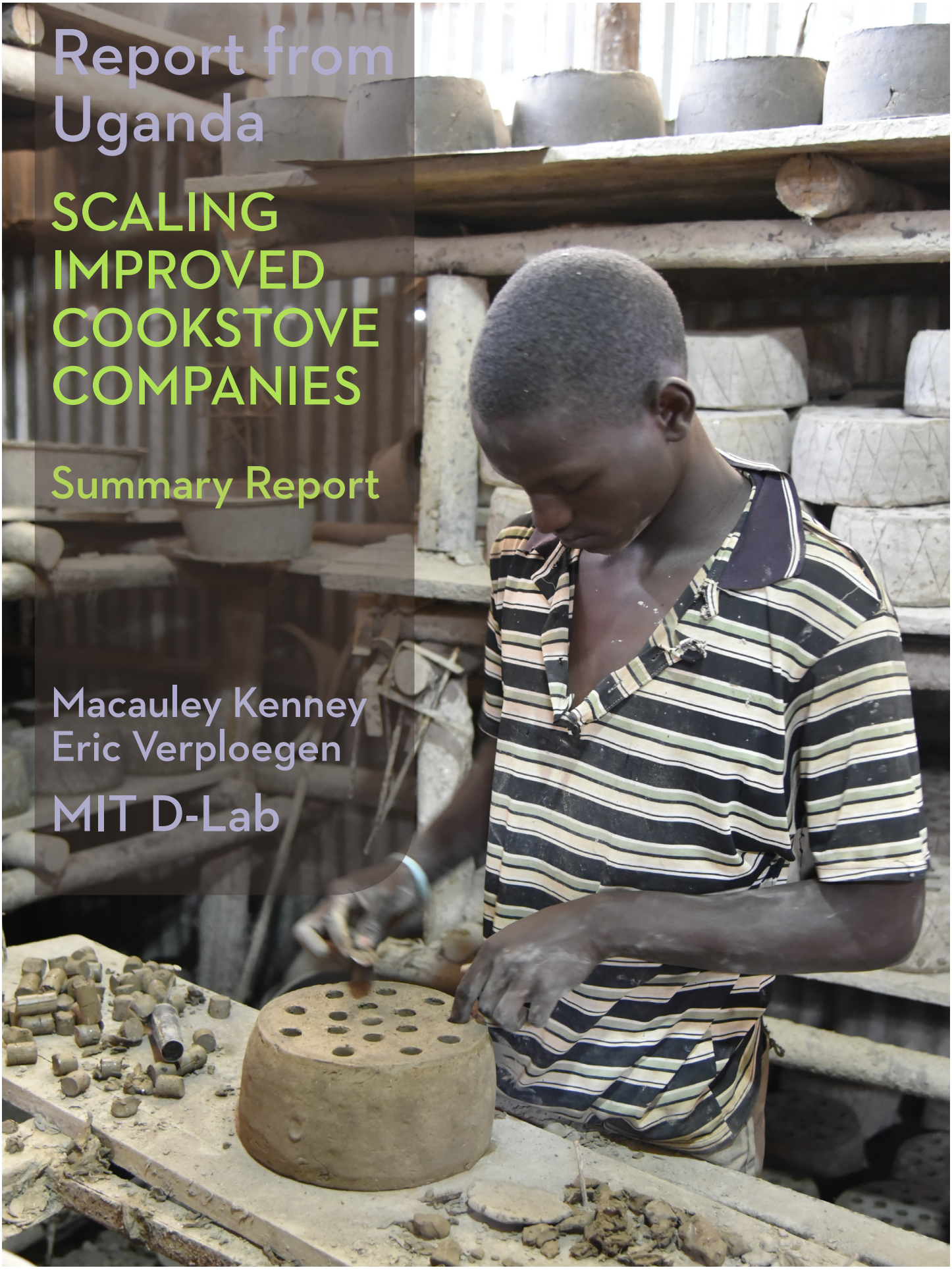

Report from Uganda

SCALING IMPROVED COOKSTOVE COMPANIES

Summary Report

Macauley Kenney
Eric Verploegen

MIT D-Lab

MIT D-Lab

Designing for a more equitable world

MIT D-Lab works with people around the world to develop and advance collaborative approaches and practical solutions to global poverty challenges. The program's mission is pursued through interdisciplinary courses, research in collaboration with global partners, technology development, and community initiatives — all of which emphasize experiential learning, real-world projects, community-led development, and scalability.

MIT D-Lab Off-Grid Energy Group

A global network of local innovators using design & technology to address poverty

D-Lab's Off-Grid Energy Group works to address energy access challenges by providing local organizations the tools to identify the most pressing needs and market opportunities in a specific community or region. We develop publicly available resources, convene stakeholders, and work directly with local organizations to design and implement programs that increase access to renewable energy solutions, such as efficient cookstoves, solar lighting, water pumps, and mechanical devices for increased productivity.

MIT D-Lab Work in Clean Cooking

D-Lab supports the adoption of clean cooking through:

- Evaluation of existing fuel and stove technology
- Design of advanced technologies
- Support for clean cooking ventures
- Participation in international policy on quality, availability, and adoption of clean cooking technology

The research team has been engaged in clean cooking technologies for 15 years, and continues to work on methodologies to measure the performance and outcomes of fuel and ICS.

Prior to this research initiative, MIT D-Lab had worked with two of the case study businesses, Appropriate Energy Saving Technology and GreenBio Energy, to provide technical support, and had provided grants to both of these companies and to Awamu Biomass Energy.

MIT D-LAB
Massachusetts Institute of Technology
MIT N51, 3rd floor
265 Massachusetts Avenue
Cambridge, MA 02139 USA

d-lab.mit.edu

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For further information contact:
Macauley Kenney macauley@mit.edu
Eric Verploegen ericv@mit.edu

Purpose

Billions of people around the globe use solid biomass to fuel their daily cooking needs. Most traditional cooking practices, such as three stone fires, produce hazardous emissions, damaging the health of the users (primarily women and girls) and contributing to global air pollution. Improved cookstoves (ICSs) have great potential to reduce the negative effects of cooking emissions, and products are applicable to potential users ranging from rural villagers to high-end consumers. However, despite the high potential for social impact, ICS manufacturers and distributors struggle with low margins, poor customer adoption, and lagging business growth (Global Alliance for Clean Cookstoves, 2015). This is particularly true in Uganda, where there is an estimated market for 6 million clean cookstoves but the sector is very nascent, with few large-scale manufactures and distributors (World Bank, 2015).

To facilitate growth of the ICS market the MIT Off-Grid Energy group conducted a research study of Ugandan ICS businesses, including in five in-depth case studies. The goals were to analyze how, if at all, the growth of these businesses depended upon the expertise and resources of the founding team. We use this analysis to suggest a low-risk pathway for ICS business growth, and to identify the challenges ICS companies may face when scaling along this pathway. We hope that with this knowledge ICS business owners will be better prepared to bring their ventures to scale, and supporting NGOs, investors, and government agencies will be better equipped to facilitate the scaling process.

Minimizing Risk by Decreasing Business Complexity

Scaling an improved cookstove (ICS) company without exposure to high levels of risk requires the company to conduct operations in:

- Financial management
- Product technology
- Product sourcing and/or manufacturing
- Distribution and sales

The number and intricacy of operations that must be met for these components to operate efficiently is the company's business complexity (BC).

To decrease vulnerability, company leaders should attempt to minimize risk while scaling. One mechanism of doing so is to minimize the complexity of their business, which reduces the number of potential hazards that could cause an operational upset. Mechanisms to minimize complexity include:

- Outsourcing part of the cookstove manufacturing and/or distribution processes (i.e. not vertically integrating)
- Relying on contract labor that can fluctuate with customer demand
- Reducing product complexity

Reducing distribution, sales, and marketing activities can also minimize complexity, but potentially hinder sales and revenue growth.

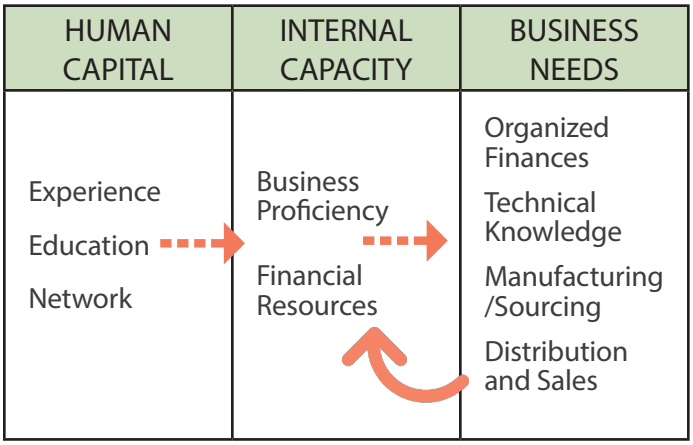
Minimizing Risk by Increasing Internal Capacity

A company's internal capacity (IC) is the ability to address the business' needs, and is comprised of:

- Business proficiency (expertise related to: financial management, product technology, product sourcing and/or manufacturing, distribution, and sales)
- Financial resources (revenue, grants, equity investment, debt financing, and carbon financing)

A high level of IC allows a company to build out its operations and scale safely, or to stabilize existing operations. IC is gained through the human capital of the company, which brings personal experiences, education, and professional networks, all of which can be leveraged to increase business proficiency and financial resources. Financial resources can also be increased through revenue generation and personal finances

In order to be operationally viable an ICS company has to have *both* business proficiencies in each of the components of BC *and* the financial resources to act on that knowledge. The two are interconnected: financial resources allow companies to afford employees with high levels of business proficiency, and high levels of business proficiency can facilitate access to, and efficient allocation of, financial resources.



Human capital (experience, education, and network) comprises company IC (business proficiency and financial resources), which is necessary to meet the functional needs of the business (organized finances, technical knowledge, product sourcing, distribution and sales). Revenue from sales can also increase financial resources.

Building Business Proficiency in the ICS Sector

Business proficiency is particularly critical in the early stages of company development. While financial resources are a valuable and necessary component of internal capacity, knowledge in business strategy, financial models, distribution techniques, and manufacturing is arguably more necessary to ensure those limited resources are effectively allocated.

Unfortunately, the need for business proficiency is often overlooked and there is insufficiently support for increasing business proficiency in the Ugandan ICS sector. The company leaders we engaged with were less likely to identify weaknesses in their personal competencies than their funding strategies, and those that did found it difficult to remedy weaknesses in expertise. Work or school opportunities that provide this experience are limited in Uganda; most establishments/organizations/individuals that offer mentorship are located in Western markets and are not accessible from Uganda. This lack of resources disproportionally effects founders who have less formal education or international networks to draw upon, a demographic that consists of more local founders than international.

Additional capacity building programs, professional mentors, and university collaborations in the Ugandan sector are all potential mechanisms to remedy this deficit, particularly those that support more than "investment ready-ness" by providing information on non-investment related topics such as distribution channel strategies, bookkeeping skills, employee management, etc. These mechanisms do not have to come exclusively from the international community, but a strong international presence could be of use as national capacity grows.

Advantage for International Founders

International founders may begin their venture with a high level of internal capacity because of the greater amount of capacity-building opportunities in Western society such as conferences, online resources, and higher education opportunities. The international founding teams in our study needed less assistance improving their business proficiency, as they already had that capacity, and instead were able to spend their resources aggressively engaging in marketing and sales, which allowed them to grow more quickly than their local peers.

Companies that demonstrate a high level of internal capacity, and subsequently a lower level of risk, are more competitive applicants for large contracts and grants. Securing contracts and grants increases financial resources, which helps the business to grow, which further increases their competitiveness in gaining future contracts and grants. Local founders, who often may not have extensive business proficiency or have the support to increase their proficiency, are effectively excluded from participating in this positive feedback cycle.

An additional consideration is that international founders, particularly those with no personal or familial ties to the region their venture operates in, enter into the market with a "boom or bust" mentality. That is, they set more aggressive scaling timelines ventures than local founding teams because they do not intend to stay in the region if the venture is not able to grow. In contrast, local founders who are personally established in the region may not share this urgency because they do not plan to depart if the venture fails, allowing them to tolerate lengthier scaling timelines.

Figure 1: Nolbert Muhumuza demonstrates an early version of a TLUD stove in Awamu's production facility.

Recommendations

When looking to grow ICS companies in Uganda, founders, managers, and organizations looking to support these businesses, should assess the company's internal capacity and business complexity. Strategic decision-making can be informed by the identification of where complexity exceeds capacity (i.e. in finances, product sourcing, distribution and sales), and whether expertise or financial resources would facilitate growth. Very often, the companies will require both at the same time. In those scenarios it is important to exercise judgment on the ability of the company to efficiently utilize funding without business proficiency. It is very possible that the external funds without business proficiency will not be impactful.

The companies in this study with full time international founders possessed higher levels of business proficiency and access to financial resources than those with local founding teams, in part due to western education and international networks, and were able to scale more quickly. This trend does not mean that all international teams are similarly enabled, or that local founding teams do not enter in with high levels of business proficiency or financial resources, but it does suggest that an increase in business proficiency might benefit a higher proportion of local founding teams.

Company leaders without strong business proficiency should seek to gain additional capacity before looking to increase business complexity and grow.

Methods of building business proficiency include:

- Participating in external business training programs (ex: accelerators, incubators, etc.)
- Implementing internal business training programs (ex: training for new employees)
- Utilizing available online business resources
- Hiring experienced employees
- Participating in local business chapters and online communities to attract attention and support from ecosystem enablers (ex: joining a clean cooking association, maintaining a company website, and creating an online presence)

Organizations supporting the ICS sector could have a great impact by increasing the number of capacity-building services available to these leaders.

Some examples of potentially beneficial programs include:

- Training/mentoring programs
- Technical support Peer-to-peer knowledge sharing
- Incubators/Accelerators

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ABOUT THE AUTHORS

Macauley Kenney holds a master's in Technology and Policy from MIT, and a bachelor's in Biomedical Engineering from Worcester Polytechnic Institute. She is a co-founder of the Rwandan brokerage Kumwe Logistics, and serves as a board member for the Institute of Engineering and Technology. She served as a research fellow at MIT's D-Lab from 2016-2017 leading this research initiative on the impact of the founding team on the growth of improved cookstove companies.Macauley has a personal interest in data-driven international development projects, particularly those focused on entrepreneurship.

Eric Verploegen, who leads the MIT D-Lab Off-Grid Energy Group, joined MIT D-Lab in 2014 to expand its research efforts in the area of off-grid energy. He has a background in materials science and earned a doctorate in polymer science and technology from MIT in 2008. Prior to D-Lab, he worked on developing materials for solar cells and waste remediation systems for the oil and gas industry. He is passionate about helping organizations based in off-grid regions identify technologies, products and distribution strategies to increase energy access in their