Capital Equipment as a Service:

*Emerging models for equipment businesses in low and middle-income economies*

By

Oluwasoga Oni

Submitted to the System Design and Management Program in partial fulfillment of the requirements for the degree of Master of Science in Engineering and Management
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ABSTRACT

Capital equipment is a critical component of almost every industry and is used to create valuable goods and services for the end customers. However, the initial cost of acquisition and subsequent running costs associated with these equipment pose a significant barrier to young businesses. While servitizing capital equipment is a proven method of increasing access to these machineries in many high-income countries (HICs), the benefits of servitization often do not extend to low- and middle-income countries (LMICs).

In this thesis, I examine the capital equipment ecosystems of both HICs and LMICs, with a focus on the stakeholders involved. I also explore both the challenges facing equipment businesses when operating in LMICs and the innovative solutions being implemented by successful LMIC service businesses. Based on these examples, I offer recommendations for budding service-based equipment business that are working to improve affordable access to capital equipment in resource-constrained settings.

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1: Introduction

Most modern businesses need capital equipment for their firm's activities. These equipment assets are used to generate revenue by creating goods and providing services for sale to the firm's customers. Therefore, access to capital equipment is of paramount importance not just to the business but also to their industries and to the larger economy as a whole. [De Long and Summer, 1995] showed the correlation between investment in capital equipment and a nation's GDP as shown in Fig 1. In their paper, De Long and Summer [1] found a positive correlation between average machinery share of GDP and GDP per worker; that is, a greater investment in equipment is connected with increased productivity per worker.

FIG 1: Equipment Investment and GDP per capita (De Long and Summer, 1995)

Over the past few decades, equipment businesses in high-income countries (HICs) have used a variety of approaches to ensure capital equipment is more affordable and accessible for the businesses that require them. Chief among these approaches has been the servitization of the capital equipment businesses. [2] Servitization is the
process of transitioning from the sales of traditional products to a bundles consisting of goods, services, services support and technical know-how. [8]

Beginning in the 1960s, equipment business shifted towards servitizing their product offerings using strategies such as equipment financing and leasing, pay-per-use models, and reusable component sales. These new models reduced the cost of ownership of many pieces of capital equipment and revolutionized the automobile, airline, photocopier, and healthcare industries among others. As a result of this shift, almost all the multinational original equipment manufacturers (OEMs) altered their traditional business models from purely selling equipment to integrating services with their products.

While these new business models centered around servitization were successful in making capital equipment more affordable, accessible and available in many HICs, they have been replicated with only limited success in low-and middle- countries (LMICs) in sub-Saharan Africa and Asia. Today, many businesses in LMICs still struggle to afford the capital equipment required to grow their companies and meet customer demand for their goods and services.

In this paper, we examine the servitization trend in HICs and highlight the key challenges related to its applications in LMICs. We also profile equipment business implementing servitization strategies in LMICs and discuss how these innovative companies are solving
the challenges of provide affordable access to capital equipment. Finally, we present a set of recommendations and guidelines for equipment businesses and organizations looking to increase affordable access to capital equipment in LMICs using servitization strategies.

1.1: Motivation

Capital equipment has never been more important as it is in today’s global economy. Besides its potential to drive economic growth [3], capital equipment also plays a critical role in providing essential goods and services for the population. As a citizen of Nigeria (a LMIC) and a startup entrepreneur working in the Nigerian healthcare industry, I have seen first-hand the growth constraint of industry that occurs when access to capital equipment is limited or not available at all.

The lack of affordable access to capital equipment has crippled a wide array of Nigerian industries, from textiles to food processing to healthcare. And when local industries fail or stall, customers must depend on foreign import of consumable goods and services to meet their needs. Looking at the Nigeria healthcare sector as a more specific example, we see critically important pieces of capital equipment as X-Ray machines, Ultrasounds, CT-Scan, MRI machine etc. Difficulty in acquiring and maintaining this equipment has meant that a sizeable swath of the Nigerian population is left without access to life-saving medical equipment that could help diagnose and treat diseases. According to the CDC, the number of CT scanners per capita in the USA is 34.3 per million in 2007[4]; in
Nigeria there is less than 1 CT scanner per 3.5 million. The failure of traditional models in this sector and many others means that new, innovative methods are required to solve the problem.

In that vein, the central question that this paper aims to answer is:

“How do we improve affordable access to capital equipment in Low- and Middle-Income Countries using servitization?”

To answer this overarching question effectively, we can break it down into three sub-questions:

1. Why don’t traditional OEM strategies for making capital equipment affordable work in many LMICs, and what are the limiting factors?
2. Can servitization strategies work in LMICs, and how do we make them work?
3. What approaches can equipment business take to apply servitization effectively in LMICs?

1.2: Thesis Organization

The rest of the thesis is organized as follows:

In Section 1 we provide an introduction to the paper, illustrate the motivations for this research, and define capital equipment and equipment businesses.

In Section 2 we explore traditional servitization models for improving access to capital equipment with a focus on HICs. We take a critical look at the stakeholders in the
industry ecosystem. Finally, we explore successful servitized business models from HICs and their impact on industry in their respective economies.

In Section 3 we examine the unique challenges facing LMICs with regard to affordable access to capital equipment. We illustrate why the traditional servitized business model, as implemented by OEMs in HICs, hasn’t been as successful in LMICs. We also explore the differences between the stakeholders in LMICs and HICs.

In Section 4 we highlight cases of successful capital equipment businesses working in LMICs and analyze how they are dealing with the different challenges associated with capital equipment in their respective countries.

In Section 5 we propose several recommendations for organizations looking to improve affordable access to capital equipment in developing countries.

In Section 6 we conclude the thesis with a summary and include some areas of further research and some final thoughts.

1.3 Background

1.3.1: Defining Capital Equipment

To explore capital equipment business and the variety business models they utilize, we must define what capital equipment is. Surprisingly, while most people agree on what
generally constitutes capital equipment, nailing down an exact definition is a trickier proposition. Its definition can vary wildly from organization to organization, industry to industry, and even country to country.

In academic literature [5], capital equipment has been defined as:

"Assets used to support business operations. Capital goods are typically high-cost, infrequent purchases that require good up-front decision-making to minimize long-term costs."

For government agencies and organizations, the definition of capital equipment is more specific due accounting and tax requirements. Here below are some of the definitions of capital equipment by some organizations and government agencies.

"A capital asset including land, structures, equipment, and intellectual property that has an estimated useful life of two or more years." [6]

"An article of non-expendable, tangible personal property which

- stands alone,
- is complete in itself,
- does not lose its identity,
- has a useful life of more than one year

has an acquisition cost that (as of July 1, 2013) equals or exceeds $5,000." [7]
The common thread through all these definition highlighted above are three factors: lifespan, cost and use. For the purpose of this paper, capital equipment will be defined based on these factors. We define

“Capital equipment as long lasting asset whose total lifecycle cost includes an initial cost, operating and maintenance cost; and are acquired solely for the purpose of producing goods and services that will be purchased by a third party (an end customer).”

For most capital equipment, its total lifecycle cost presents a considerable barrier to entry because it includes both operating and maintenance cost. The Total lifecycle Cost can therefore be simply described as follows:

Total lifecycle Cost = Initial Cost + Operating monthly fee* Lifespan + Lifetime maintenance cost

1.3.2: Definition of Equipment Businesses

Equipment businesses are organizations whose goal is to provide capital equipment for other businesses that in turn use the equipment to create goods and services for end customers. Equipment business are usually capital-intensive ventures themselves, and can be categorized as either Original Equipment Manufacturers (OEMs) and OEM
affiliated partners or Secondary Equipment Providers (SEP) who are OEM agnostic and act as middlemen between the OEMs and the businesses that uses the equipment to create value for the end users. Examples of these business with their corresponding industry is shown in TABLE 1 below:

<table>
<thead>
<tr>
<th>Business</th>
<th>Industry</th>
<th>TYPE</th>
<th>Examples of business customers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xerox</td>
<td>Photocopier, Office</td>
<td>OEM</td>
<td>Offices,</td>
</tr>
<tr>
<td></td>
<td>Solutions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GE Healthcare</td>
<td>Healthcare</td>
<td>OEM</td>
<td>Hospitals</td>
</tr>
<tr>
<td>United Rentals</td>
<td>Industrial, Construction</td>
<td>SEP</td>
<td>Home Developers and Contractors, Farmers</td>
</tr>
<tr>
<td>International Lease Finance Corporation</td>
<td>Airline</td>
<td>SEP</td>
<td>Airlines</td>
</tr>
</tbody>
</table>
2: Review of traditional capital equipment businesses

2.1: Overview

While access to capital equipment can spur economic growth of industries, the nature of capital equipment presents a huge barrier to easy access. Capital equipment is often expensive to acquire, has running cost, and requires a fair amount of technical know-how to operate, in addition to needing regular maintenance service, the occasional repair, and access to spare parts. [2]

These challenges affect both the capital equipment businesses that sell capital equipment and the business customers who buy capital equipment. Key considerations for the capital equipment businesses are as follows:

- Driving up revenue via sales and services (figuring out how to turn a one-time sale into a multiple-revenue-generating opportunity)
- Making capital equipment more accessible to the business customers.
- Competing with other OEMs and gaining market share in the marketplace.

On the other hand, the capital equipment business customers are focused on:

- Reducing the total lifecycle cost of equipment
- Financing the equipment purchase
- Ensuring seamless equipment operations with little or no downtime

Servitization emerged to bridge the gap between the needs of the equipment business and the equipment business customers. These new servitized business models enabled equipment business customers to acquire equipment easily without great impact on their cash flows. In addition, it helped the equipment businesses that implemented
servitization gain market share, increasing revenue from customers and improving the brand name and recognition.

2.2: Servitization as a solution

Sandra Vandermerwe and Juan Vada [8] first documented the trend towards servitization comprehensively in their 1988 paper. In the paper, they described servitization as a transition by manufacturers from traditional product sales to “bundles, which consist of a customer focused combination of goods, services, support, self service and knowledge”. Baines et al [9] went further with their definition, describing servitization not just as simply adding more services to existing products within large multinational companies, but also as viewing the manufacturers as service providers who aims to improve the customers’ processes through innovating the business model. This requires a change in perspective on the part of the manufacturers in how the organization is setup and how their business is structured.
FIG 2: Contrasts between a product system and product-service system

Source: Baines et al, Made to Serve [9]

Fig 2 shows the major differences between a product-focused business model and a
servitized business model. In a product-focused model, as shown in FIG 2A, the OEM manufactures a product that is sold to the business customer. After that purchase, the responsibilities of ownership lie with the business customer; therefore, the customer is responsible for financing, maintenance, repair and overhaul of the capital equipment. In this transactional-based production-consumption model, the revenue stream of the OEM is based only on product sales and spare parts [9].

In the servitized business model, as shown in FIG 2B, the OEM still manufactures the equipment, but the responsibility of ownership is shared with the business customer. The OEM evaluates the customer’s need and then provides them with the capabilities to solve those needs. The OEM, rather than the customer, is responsible for the performance and upkeep of the equipment, and the OEM receives revenue as the business customer uses the equipment [9]. The extent to which the OEM shares the responsibility of ownership with the business customer shows the degree of servitization of a business model. In a fully servitized model, the OEM is responsible for the financing, equipment operation, maintenance, repair, performance monitoring, and overhaul of the equipment. Fully servitized models like this are also called solution services because the business customers are buying a fully integrated solution. [2] Meanwhile, a hybrid servitized model might see the OEM responsible for maintenance, repair, overhaul and performance monitoring, but the customer will be responsible for financing (usually from a third party) and equipment operations.
Servitization offers several advantages for both the OEMs and the business customers.

Servitization enables OEMs to:

- Compete effectively in highly competitive environments [11]
- Secure revenue streams from business customers as the services contracts are usually long which often results to customer lockdown. [8]
- Improve relationships with customers that result in customer retention. [8]

For the business customers, servitization allows them to:

- Enjoy lower barriers to accessing capital equipment, as upfront costs are lower [12]
- Focus on their end customers instead of equipment operations [8]
- Be more flexible as they can scale up and down as required. [12]

2.2.1: Effects of Servitization

In the US and many other HICs, the implementation of servitization strategies has reduced the barrier to entry to capital equipment and led to the exponential growth in many industries such as agriculture, construction, automobile, and healthcare among others. Organizations like Xerox and Roll Royce championed this new way of looking at services, and several other multinationals OEM followed suit. [12] Now it is generally accepted wisdom that servitization on some level is required by manufacturers of capital equipment to compete. [12]
2.3: The Ecosystem of Servitization in HICs: Stakeholders Analysis

This move towards servitization has revolutionized industries in the higher income economies. To understand the success of servitization in these industries in HICs, we need to understand the ecosystem in which servitization was implemented, the stakeholders within the ecosystem, and how the stakeholders interact with one another. In this section, we take a critical look at the stakeholders, highlighting their function within the ecosystem and their interactions. The key stakeholders are described below:

- **Original Equipment Manufacturer**: These are the equipment businesses that actually manufacture capital equipment. Traditionally, they focused on the sales of the capital equipment but have gradually shifted into providing equipment services and solutions for the business customers. FIG 3 shows the relationship between OEMs, secondary equipment providers and business customers.

![FIG 3: Relationships between OEMs, SEPs and business customers.](image-url)
• **Secondary Equipment providers:** These are equipment businesses do not manufactures the equipment but rather they partner with OEMs to provide business customers with their equipment needs. SEPs in HICs typically add value for the business customers by on providing equipment service and solution instead of just reselling product from the OEMs.

• **Business Customer:** These are the businesses that require capital equipment to produce goods and/or services for the end customers.

• **Government Institutions:** These are government agencies that regulate the industry, trade, financing, and legal environment. Examples of these government institutions include Customs, Trade Ministries, Internal Revenue Services, and Environment Protection Agency. They set the rules for how organizations should behave in business and can incentivize good business practices via tax exemptions and tariffs. Legal Institutions can also help arbitrate contract disputes between equipment business and business customers. Strong and favorable governmental institutions are essential for successful servitization.

• **End users:** These are the final beneficiaries of the good and services produced by capital equipment. End users are typically paying upfront for these good and services and are sensitive to cost and quality of good and services.

• **Financing institutions:** These are institutions that provide the funds necessary for the financing of capital equipment for the business customers. The presence of strong financial institutions is critical to the success of servitization in any country. To assess the credit risk profile of equipment businesses and their
business customers, financing institutions usually involve credit rating agencies.

- **Aftermarket**: These are alternative marketplaces where business customers can gain access to product and services as substitutes to the OEMs. The secondary equipment market usually sells refurbished goods and services at a lower cost than that of the manufacturers. Business customers can sell older equipment into these markets when they upgrade, and this equipment can be in turn used to service the lower end of the market that cannot afford premium goods and services. For a successful secondary market, there must be enough technical know-how about the capital equipment in the marketplace.

- **Credit Rating Agencies**: They determine the credit risk profile of the business customers and the OEMs. This information is then used by financing institutions to determine the credit worthiness of a business.

- **Collections Agencies**: These are organization used by financing institutions and OEMs to recover equipment from defaulting business customers. They rely on the legal institution to carry out their work. The recovered machines are often sold in secondary markets.

While all these stakeholders are necessary for the success of servitization in many industries, the relationship between them and how they interact may differ from industry to industry. For example, in the US auto industry, manufacturers focus on manufacturing and selling the product to their car dealers (secondary equipment providers) while these car dealers in collaboration with financial institutions provides
financing, leasing, maintenance, repair and overhaul services for the end customer as shown in FIG 4. [13] Alternatively, in the US healthcare industry, GE Healthcare has implemented a fully integrated service approach in which the equipment is manufactured and financed internally for the hospitals while GE also provide the maintenance, repair and overhaul of medical equipment as shown in Fig 5. [14]
FIG 5: Solution Services Model

2.4: Servitization Case Studies in HICs

In this section, we evaluate how HIC equipment businesses have used servitization to increase affordable access with respect to their respective capital equipment.

2.4.1: Xerox – Competing using a servitization strategy

2.4.1.0: Company Background

Xerox Corp. is an American fortune 500 company based in New York who provides world-leading enterprise for business process and document management solution. [15]. Xerox was established in 1906 as Haloid Photographic Company. In 1947, Xerox
collaborated with Chester Carlson to commercialize the xerography technology he had invented. [9] With the release of the Xerox 914 paper photocopier, Xerox became very successful. Since then, Xerox has gone on to dominate the office equipment and business marketplace in the US and across the globe. Xerox Corporation was one of the pioneers of servitization as a business strategy and has used it in various forms both as a market entry and competitive strategy as explained below.

2.4.1.1: Xerox: Servitization as a tool for capital equipment affordability

As at the time of the release of the Xerox 914 photocopier, the prevailing business model in the marketplace among their competitions was “product sales plus disposables/spare parts’ approach. [9] Even though Xerox photocopying technology was unique and vastly superior to the competitions, it wouldn’t justify the premium prices that business customers would have to pay to own it. It cost $2000 to manufacture their product while it cost their competition $300. [9]. To tackle this challenge, they implemented a leasing model where business customers leased the photocopiers for a relatively low fee ($95) and in addition, provided exclusive support services as well as the first 2000 copies every month (meanwhile competition’s chemically treated paper cost 15 cents per sheet). [9] They also allowed no-frills contract cancellation with 15 days notice. [9] Xerox’s servitization model was novel and changed the document duplication industry landscape. It made photocopiers accessible and affordable for a large number of business customers who wouldn’t be able to afford one using the prevailing product-focused business model offered by the competition. It also created a very profitable
aftermarket from which competition was locked out. [9]

Between 1959, when the Model 914 was introduced, and 1961, Haloid nearly doubled its revenues. As the result of this extraordinary success, the company changed its name to Xerox Corporation in 1961. During the course of the model 914 lifecycle, Xerox manufactured more than 200,000 units and its revenues grew from $30 million in 1959 to $2.5 billion in 1972. In 1972, the company controlled 60% of the photocopier market and 95% of the plain paper photocopier business.

In fact, this move quickly turned the company into a monopolistic giant in the photocopier industry that was sued by the U.S. government. Xerox lost the legal case and was forced to license their technology to their competition. [9]

2.4.1.2. Xerox: Servitization as tool for competing with low cost competition

In addition to licensing their technology, Xerox was also required by the US government to begin selling their products and allows competition to provide services for Xerox product. [9] After being wildly successful for several decades, Xerox experienced slowing sales in the 1970s & 1980s due to increasing competition from Japanese manufacturers. [9] The Japanese manufacturer’s low-cost photocopiers (such as Canon and Fuji) had improved technology and required relatively little maintenance. These competitors entered into the lower end of the market and slowly crept into the high-end market in a classic case of disruption*, as described in Clay Christensen’s Innovator’s Dilemma [16].

1 *Clay Christensen’s disruption innovation theory describe the process by which a product or service starts out with simple applications at lower end of the market and then relentlessly moves up market, eventually displacing established competitors
Xerox responded to these pressures by changing direction, using another servitization strategy. According to a servitization impact study [24] by Tim Baines, “Xerox started looking at the printing environment from a holistic perspective rather than just assuming that customers simply wanted cheaper equipment and supplies. The drive was to provide services that would gain control over all aspects of their printing, and the result was the creation of Managed Print Services (MPS).” [12]

According to Fillipo [9], “MPS can be generally defined as solutions aiming at optimizing and managing the customers’ document output environment. Such an environment includes photocopiers, scanners, printers, and fax machines, as well as their consumables and outputs, the processes that these devices enable (mailing, scanning, copying, faxing, archiving, distributing, sharing), and the people involved in these processes.”

Following the paradigm shift towards service solutions, Xerox revenue in the managed services segment skyrocketed and even exceeded product sale revenues. In 2012, 84% of Xerox’s $22.4 billion revenue was annuity-based, with services revenue growing 6% from 2011, to $11.5 billion. [12] The company grew from its origins, delivering on-site, small-scale contracts, to become a professional shared service organization delivering substantial outsourcing contracts to its customers, underpinned by its own technology. [12]
2.4.2: United Rentals: Driving efficiency with Servitization

2.4.2.0: Company background:

United Rentals, Inc. is the largest equipment rental company in the world with rental locations throughout the U.S., Canada, and Mexico. With more than 400,000 big pieces of machinery and tools, including forklifts, bulldozers, jackhammers, and utility trailers, spread across 880 branches in the U.S. and Canada, United has about 12% of the industrial rental market—more than its next two competitors combined. United's customers are construction and industrial companies, utilities, municipalities and homeowners.
2.4.2.1: Industry Challenge

With the success of servitization by several US OEMs, there was an increase in the number of small equipment rental stores (OEM agnostic equipment businesses) dealing in construction and agricultural machinery across the US. The scale of each of these operations was small however, which meant that the price customers paid for the equipment services (leasing, renting etc.) was high and the quality of service provided varied wildly across business to business. As a result, customer satisfaction with these secondary equipment business services was quite low.

FIG 7: Equipment Rental History in the US
2.4.2.2: United Rentals Approach

To solve these customers’ pain points, United Rentals started by acquiring smaller equipment services operations across the US and focused on improving the quality equipment services to the business customer. [25] They achieved this by:

- Driving operational efficiencies across the board by sharing equipment across locations: Gathering data about their business customers enabled them to know what kind of equipment were popular in each location and enable them to position their equipment optimally across multiple location. When there is a surge in demand for certain equipment, adjacent locations can provide the equipment. [24]

- Centralizing operations: Prior to acquisition, each of the equipment rental office ran the business independently and several activities were replicated across multiple locations. After United Rentals consolidating these businesses, several cost driving business activities (e.g. marketing, advertising, call centers etc.) was centralized, this reduced the cost of operations in each business location [24]

- Providing superior standard of service the customers. United Rental has extensive customer service network consisting of 881 service locations and centralized call centers with online capabilities [24]

- Implementation of lean management techniques such as Kaizen process on continuous improvement which aims to reduce renting cycle time, improving invoice accuracy, and also improving the effectiveness and efficiency of
repair and maintenance operations [24]

- Expanding equipment options by partnering with more OEMs. United Rentals offers approximately 3300 classes of equipment for rent to construction and industrial companies [24].

As a result of these strategies, United Rental is the undisputed leader in the equipment rental services in North America, even though the equipment rental market is highly competitive and fragmented. The benefits for customers are obvious: industrial and construction equipment are relatively easy to acquire in the US/Canada either via direct purchase, financing, leasing, renting or other equipment solution services.
3: Unique challenges for capital equipment businesses in LMICs

3.1: Overview

Servitization has emerged as a key strategy used by manufacturers of capital equipment and other equipment businesses to promote wider access to their inventories [10] and to drive business efficiency; however, its success has not been felt evenly across the globe. Many LMICs, particularly in Africa and South East Asia, still struggle with affordable access to capital equipment across many industries. The benefits of servitized business models that have been widely adopted by OEMs in HICs (such as the US and Western Europe) have not yet spread to lower income countries. The inability to access capital equipment has contributed to the slow growth of industries in the economy of these LMICs. Understanding the challenges faced by companies in the LMICs is key for OEMs, other service providers, and any stakeholders interested in increasing affordable access to capital equipment.

3.2: Major differences HIC and LMIC Industry Ecosystem:

The key-driving factor behind many of the challenges is the fact that industry ecosystems within LMICs are vastly different from those of HICs. Some of the major differences are as follows:

- Some of the key stakeholders required to make servitization successful either do not exist or but cannot play their role effectively in the ecosystem. Example of stakeholders that doesn’t exist in any real capacity in many LMIC includes credit rating agencies, collections firms, strong legal framework, robust aftermarket.
among others.

- LMICs don’t represent the primary markets for many OEMs. Therefore there is a general reluctance to invest the considerable amount of resources in these countries to make servitization successful. In some LMICs, the OEMs and their channel partners are not usually present in these countries in any real capacity. While they might have marketing offices in these LMICs, technical support and engineering offices are located outside the country and have to be brought in whenever they are needed.

- Finally, many OEMs tend to extend their high margin, premium product focused business models from HICs to LMICs. However, the financial capability of most end users in LMICs is usually lower than that of the end users in HICs. Hence, the business customers are very price sensitive when they purchase capital equipment because the value they can capture from their equipment is much lower than similar businesses in HICs.
The figure below is a simple illustration of the healthcare industry in Nigeria.

**FIG 8: Diagram of key stakeholders in Nigerian Healthcare Industry**

3.3: Challenges facing LMIC economies

LMIC economies face unique challenges that are not usually seen in higher income countries. The challenges faced by LMICs can be categorized under four broad categories.

- Capital

  - Lack of access to financing
  
  - Lack of credible credit rating agencies

- Technology
• Low level technical know-how about product
  • Few technical personnel on the ground
  • Lack of technical training resources

• Government and Macroeconomic conditions
  • Political Instability
  • Weak Government Institutions
  • Unfavorable regulations
  • Corruption
  • Foreign exchange instability

• Market
  • Fragmentation
  • Lack of availability of aftermarket and third party providers
  • Fierce low cost competition
  • Logistics

3.3.1: Capital Challenges

By nature, capital equipment is usually expensive and usually requires financing from either the OEM or a financing institution, such as a bank or leasing company, at a low interest rate. In many developing countries, OEM financing is not available and obtaining financing from a banking or leasing institution is usually a big hurdle. Even when business customers can get access to these loans, the interest rates are usually very high. In such instances, it is almost impossible for business customers to access the
required equipment because the cost of capital is too high.

Another driver of the high cost of capital is that banking institutions know too little about certain industries, especially those to whom they haven’t traditionally lent. There is little to no credible way for the banking institutions to assess how much of the credit risk a particular business customer represents due to a paucity of credit rating agencies in many developing countries. This result in a blanket interest rates on loans that are prohibitively high for many business customers.

Equipment business importing capital equipment needs foreign exchange (usually USD) to facilitate the payment of suppliers and manufacturers outside the country. If there is scarcity of hard currencies for international transactions or exchange rate volatility, it will affect the ability of equipment business import the equipment. [17] Consequently, the cost of the equipment is increases thereby affecting the ability of the business customers to afford them.

3.3.2: Technology Challenges

Capital equipment is usually a high technology good. They require a significant amount of technical know-how in order to operate the equipment, in addition to specialized technical knowledge to maintain and repair the equipment. Given that most equipment businesses in developing countries are just middlemen, selling capital equipment purchased from multinational OEMs, they need to acquire the technical know-how from
the OEMs to service the equipment at the business customer sites. For most OEMs, technical training is a revenue generating opportunity and often represents a business unit within the larger organization. As a result, technical training resources are tightly controlled and many technical personnel in developing countries don’t have access to these resources. The absence of technical training resources on how to maintain, repair, and operate the capital equipment means that in many LMICs only a handful of individuals are trained on machinery operation and servicing. These highly sought individuals tend to leave their respective countries when there are better paying opportunities abroad.

The complex and complicated nature of the capital equipment can be a barrier in many developing countries. Complex and complicated capital equipment usually require high degree of knowledge to operated, maintain and repair. In industries where there are low numbers of technical personnel with the technical expertise on the ground, there is less chance that business customer acquiring such equipment even when they need it.

Another huge factor hindering access to capital equipment is that many pieces of capital equipment are designed for HICs and may not be a proper fit for the environment in an LMIC. Sometimes the equipment is ill prepared to stand the punishing tropical climate of many developing countries, and other times the equipment is intentional designed by OEMs to use expensive disposables that business customers in developing countries struggle to afford or even find reliable source for. In short, there is a huge gap between
what the business customers want, what they can afford, and what is available in the market.

3.3.3: Government and Macroeconomic conditions

As equipment business in developing countries often have to import these machineries from manufacturing faculties outside the countries, they have to deal with different government agencies and their bureaucracies during the process. These agencies may include customs, environment agency, standard agencies etc. The costs of dealing with these government agencies are eventually passed on to the equipment business that in turn pass it on to the end customer. These costs ultimately affects how affordable the equipment is and how readily available the capital equipment is. In some cases, OEM may decide not to enter a particular market just because of the hurdle of navigating this process.

Another unfortunate situation in many LIMC is corruption, pervasive in some government institutions. [16] Equipment businesses may compete with other businesses that don’t pay the same taxes and tariffs or those firms that get illegal waivers because they have government officials in their pockets. Such anti-competitive behavior may benefit a few companies, but it hurts the industry as a whole.

Finally, given how linked the governments of many developing countries are to the many major industries within it, the industries are vulnerable to any changes to the
status quo. Political turmoil or change in government often leads to business uncertainty over government policies that affect accessibility to capital equipment.

3.3.4: Market

The market conditions of LMICs differ from those of developed countries in several ways. End users in LMICs have lower financial capability than those in developed countries. Hence, business customers can’t charge the same high margins for goods and services as their counterparts in HICs. This limitation decreases the ability of business customers in LMICs to purchase top-of-the-line capital equipment. Even with servitization strategies offered by OEMs, such as leasing or financing, the LMIC business customer still cannot afford this equipment. This fact means that many multinational OEMs can’t capture as much value from their products (for mostly incremental innovations on top of the line new equipment) as they can in wealthier economies, and, as a result, many multinational OEMs are discouraged from looking at these developing countries as viable markets. This has left a gap in the marketplace for capital equipment in these countries.

To fulfill their needs for capital equipment, business customers in these developing countries look up to low-cost Asian manufacturers and also buy older used equipment from used equipment dealers. This has led market fragmentation in many industries with a variety of OEMs and secondary market retailers competing mainly on price. The consequence is an influx of sub-standard capital equipment in these countries. Another
downside to this approach is that the lower-cost option come with no after-sale support services, access to spare parts and good technical personnel can be extremely limited in these countries. When capital equipment breaks down or no longer functions properly, the business customers struggle to find repair services.

Some large multinational OEMs are also increasing rethinking their approach to LMICs by redesigning their products for more market suitability, striping out features that are not critical to equipment functionality and establishing design centers in those countries. The main challenge with this approach is long lead-time to design, build, and commercialize a new product is usually long (> 5 years).

Another challenge that is unique to the capital equipment marketplaces in many developing countries is logistics. Getting to rural and semi-urban places within these countries is quite difficult and adds to the cost of the capital equipment. Also, given that many pieces of capital equipment are delicate, there is higher likelihood for some sub-system to break down due to the poor transportation networks often found in LMICs.
4: Emerging service models in developing economies: Case studies

Despite the challenges of providing capital equipment to businesses in developing countries highlighted above, improving the access to capital equipment can generate huge opportunities for business customers and spur the growth of entire industries in developing nations. Increasing affordable access to capital equipment is now the focus of several innovative organizations across many developing nations. These organizations are improving the affordability and accessibility to capital equipment by rethinking and tweaking servitization strategies to suit their marketplaces. In this section, we examine three cases studies of these companies and explore how they are changing the industry landscape.

4.1: Panafrican Agriculture, Nigeria: Product-Service Combination

4.1.0: Company Background

Panafrican Agriculture (PAA) Nigeria is a subsidiary of the Panafrican Group based in Kenya. The Panafrican Group has investments mostly in construction and mining in East Africa. They entered the Nigeria agriculture and construction industry in 2013 and have quickly become one of the leading providers of construction and agriculture machineries in Nigeria. They are an OEM-agnostic equipment business that carries equipment from multinational OEMs such as Komatsu and VALRA. The case-study is based on information from my interview with the CEO of PAA, Jamie Dixon.
4.1.1: Industry Challenges

Nigeria has a population of over 180 million people but has one of the lowest rates of mechanized farming in the world. [22] When PAA entered Nigeria, the mechanized agriculture industry was still in its infancy, and, in many respects, it still is today. Due to the high amount of capital required to purchase tractors and other farm equipment and the scarcity of financing, many large-scale farmers bought the cheapest machinery they could find in the marketplace. This led to an influx of low quality, but inexpensive machinery from OEMs based primarily in East and South East Asia. The downside of this low-cost machinery was its difficulty to maintain and repair and the limited access spare parts. In addition, since the OEMs compete solely on the upfront cost of purchase, they had little to no technical expertise on the ground nor did they provide service support after equipment purchase. Another crucial pain point was the paucity of experienced equipment operators on the ground.

4.1.2: Panafrican Agriculture’s Approach

One of the first things PAA did when they entered the Nigerian marketplace was to conduct a survey of the machinery of the ground. They discovered that in most cases, many of the machineries were not a good fit for the environment where they were being used, leading to frequent breakdowns. PAA then researched product inventories from leading multinational OEMs such as John Deere, Caterpillar, and Komastu. After thorough analysis, PAA chose Komastu and VALRA as their flagship product suppliers.
PAA understood that it was important to provide great technical support to their customers in addition to great, environment-appropriate products. PAA developed a free technical training institute to train their customers’ technicians as well as PAA technicians. PAA strive to train their customers’ technicians to be as knowledgeable as their own in-house technicians. In return for investing both time and materials into training the customer’s technicians, these technicians can be called upon by PAA to help with another customer’s equipment issues. These technician functions as an extension of the PAA support infrastructure for their customer base. This is particularly important as the customers are spread out over a large geographic area, so it would otherwise be challenging for PAA to send technicians from their central office in Lagos. As a further preventative measure, PAA preempts equipment downtime by packaging the most vulnerable spare parts with each equipment purchase.

Finally, PAA understands how difficult it is for these farmers to get financing from banking institutions. While PAA doesn’t provide financing directly to their customers, they partner with the farmers to seek financing from both local and international institutions especially those focused in growing agriculture in Nigeria. Because the company already has close ties to these financial institutions, it is easier for the farmer to get the financing for their equipment needs when backed by PAA.

In just couple of years, PAA has become highly successful and is one of the leading providers of agricultural equipment in Nigeria. Many large-scale farmers
overwhelmingly prefer the PAA model to the models of other providers. Their customer retention rate is above 90%.

4.2: MDaaS: Turn Key Medical Solutions

4.2.1: Company Background

MDaaS is a MIT-born medical device services organization that was launched by me as part of the Development Ventures class at the Sloan Business School. The vision of the organization is to improve affordable access to high-quality medical equipment in Nigeria and across the African continent. To achieve this goal, MDaaS provides flexible acquisition options (direct sales, leasing/renting, and equipment partnerships) and world-class service support with each device. MDaaS launched in officially in May 2015 and currently works with five hospitals in three states in Nigeria.

4.2.2: Industry Challenge

Medical devices can transform the healthcare landscape and dramatically improve health outcomes around the globe. However, access to life-saving medical equipment and supplies is far from universal. According to the WHO, at least 40% of medical equipment in sub-Saharan Africa is currently out of service. [19] In Nigeria, and many other sub-Saharan African countries, this dearth of functioning medical equipment means that many diseases are diagnosed too late or not at all and that life saving equipment is not available to the hospitals.

From my market research, the challenges that many hospital administrators face are:
- The high-cost of medical equipment with few or no financing options available.
- A lack of trusted maintenance and repair services in the country.
- A lack of service support from manufacturers as most equipment is purchased second-hand and with no after-sale technical support.
- A lack of the knowledge and experience necessary to identify the product specification required for a hospital’s specific needs.

From the industry point of view, the challenges are as follows:

- Lack of good technicians to support equipment.
- Highly fragmented marketplace that competes mostly on equipment purchase cost.
- Inexperienced operators.
- Lack of financing from banks.
- Weak government institutions.

4.2.3: The MDaaS Approach

In order to address the challenges described above, MDaaS provides a unique combination of high-quality refurbished medical equipment and maintenance and repair services to hospitals in Nigeria. To ensure hospitals gain access to high-quality devices, MDaaS offers acquisition options to fit a range of budgets. To fill the gap in skilled biomedical engineers, we train engineers through a biomedical fellowship program. To keep devices safe and operational at all times, we provide pre-planned maintenance and repair services. Through this combination of services, MDaaS maximizes hospital
and patient access to life-saving diagnostics tools, reduces equipment downtime, and ensures that devices are used safely and efficiently.

Similar to the PAA’s approach to product fit, MDaaS evaluates the medical equipment landscape and carefully selects devices that are a fit for the Nigerian environment from both a market perspective (cost that the hospitals are willing to pay) and from a technology/feature view (makes sure it meets our customer use requirements). For each model, we choose devices that are easy to maintain and repair, and for which spare parts can be easily sourced locally or from our suppliers in the US. In many cases, the medical equipment chosen by MDaaS are slightly older models of equipment, which are in refurbished before selling to Nigerian customers. The driving factor for this is because these refurbished equipment meet the product features and performance requirement the customers want, and are significantly cheaper than new models.

MDaaS provide a variety of acquisition options designed to reduce the barrier of entry to accessing the medical devices for the hospital. These options include direct sales for hospitals that can afford them outright, flexible payment and leasing/renting service. This approach ensures that upfront cost barrier is greatly reduced.

MDaaS offer world-class service support with each of the devices. MDaaS is one of the few medical devices services organization in Nigeria to offer service support on refurbished equipment. Since the responsibility of ownership is shared between MDaaS and the business customers (hospitals), the hospital can focus more on their clinical operation rather than equipment maintenance and repairs.
To offer world-class service support, MDaaS is creating a pipeline of talent through a biomedical technician fellowship program. This is critical to maintaining organizational knowledge within MDaaS. Successfully trained technicians are expected to train upcoming technicians. This ensures that even when a few technicians leave for greener pastures, there would still be talent on the group to maintain the MDaaS service structure.

MDaaS launched its pilot officially in January 2016 and currently works with five hospitals in three states in Nigeria. The MDaaS service model has gained significant support within the Nigerian Healthcare ecosystem. The MDaaS recently got $50,000 grant from the Nigerian Health Innovation Marketplace (NHIM) to further its mission and vision. [23]

4.3: Tugende: Innovative financing for transportation equipment

4.3.1: Company background

Tugende is a for-profit social enterprise started by Michael Wilkerson and Matt Brown in Uganda in 2010. Tugende helps motorcycle taxi drivers buy their own motorcycles via a leasing to own scheme, giving the drivers a path to self-employment and financial independence. [20]

4.3.2: Industry Challenge

Motorcycles (also called boda boda) are a key part of the transportation in Uganda and are quite popular. Uganda is home to almost 400,000 motorcycle-taxis. Among these,
80,000 are located in Kampala, the capital city. Eighty percent of the drivers of these motorcycle taxis do not own their own bike. They typically rent them weekly or daily without any form of contract, which means that their livelihood can be taken away from them at any time. Also, since most of their earning is spent renting the vehicles, there is little or no options for them to eventually own the taxi.

4.3.3: Tugende Approach

Tugende provides the taxis to recommended drivers in a lease-to-own arrangement that enables the driver to own the motorcycle after 19 months or less. Applicants for this program come primarily from existing networks of trustworthy drivers and recommendations from passengers. Potential drivers must complete a three-week course on safety, company rules and customer service.

Drivers that complete the training are vetted through the Tugende screening methods. These include scores of creditworthiness, in-person family visits and a pledge of support from the leader of the driver’s local network. This process helps identify the most trusted, responsible and committed lease recipients.

Once selected, drivers select a brand new motorcycle of their choice (primarily Bajaj Boxer) and begin making weekly payments. Tugende’s standard lease is repaid over a 19-month period with principal and interest components. All drivers have the option to repay earlier (at no penalty) thereby offering considerable potential savings in
interest payments. Drivers make their weekly payments only through mobile money or through an e-payment kiosk. [21]

Tugende has grown substantially since inception. They have helped 700 drivers own motorcycles, have about 2000 drivers in the process currently and another 2000 on the waiting list. They have expanded in three other cities in Uganda and have plans to expand into other East African cities with the same problem with access to financing for motorcycles. [21]
5: Lesson Learnt: Recommendations for equipment businesses in developing economies

Based on the case studies conducted with the organizations discussed above and my experience running a startup providing capital equipment to businesses in LMICs, I developed a framework for other equipment businesses and organizations looking to increase access to affordable access using servitization strategies.

<table>
<thead>
<tr>
<th>Framework for Servitization in developing economies</th>
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<tbody>
<tr>
<td>1 Find the right Product Fit</td>
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<td>2 Training is key to building capabilities</td>
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<tr>
<td>3 Seek out beneficial Partnerships across the value chain</td>
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<td>4 Innovate using technology</td>
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<td>5 Be lean and flexible</td>
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<td>6 Target private customers before government patronage</td>
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Table 2: Framework for servitizing in LMICs

5.1: Find the right product fit

The most important decision equipment business interested in servitization must make in developing market is which product to position in the market. The product (which in this case is the capital equipment) must be a fit from both the market and technology point of view. Equipment businesses must ask themselves a few questions when assessing if a particular capital equipment are fit for servitizing in that particular environment.

Under the market perspective:
Can the business customers afford the equipment?

How much revenue that the capital equipment create for the business customer and how much are the end customer willing to pay for it?

Does the business customer have access to financing?

Under the technology perspective:

Can the capital equipment operate in the environmental conditions where it will be used?

How easy is the equipment to maintain and repair and if spare parts can be easily obtained locally?

What are the key features of the equipment and does it meet the requirements of the business customer?

Overall, equipment business should ensure that there is a match between the capital equipment and the environment in which it will be operated. In some cases, newer is not necessarily better. An older product from the OEM might be a more appropriate market fit from a market and technology point of view than a newer machine that was designed explicitly for higher income market with many features that the lower income market doesn’t need.

5.2: Training pipeline is key to building internal capabilities

Equipment businesses looking to servitize in LMICs must find ways to train personnel on equipment operations but also train on maintenance and repair of the capital
equipment. They must have the internal capabilities to train continuously so that even if
some trained personnel leave for better opportunities, it would not be the end of their
operations. One way of doing this is by having an internal business unit focused on
training, such as the training programs used by MDaaS and Panafrican Agriculture.

5.3: Seek out beneficial Partnerships across the value chain

To be successful in LMICs, equipment businesses must take on activities that are not
within their core activities to overcome weak ecosystems. Adding these activities can
quickly overstretch equipment businesses and derail them from their goals. To prevent
this, equipment businesses can partner with others within and outside the immediate
industry to perform these activities. In the Tugende case study, they partnered with the
local association of taxi drivers to help assess the credit risk of each potential driver.
Similarly in the Panafrican Agriculture case, while PAA couldn’t provide financing capital
for the business customers, but they advocate on behalf of their clients with financial
institution (whom they are affiliated with) to provide financing for the customers.

Another area where partners can play a critical role is logistics. In many developing
nations, there are organizations already on the ground with experience navigating the
tough terrains of the LMICs. Working with these existing organizations will accelerate
the speed at which equipment businesses can achieve their goals.
5.4: Innovate using information technology

Innovative use of technology can bridge the gap between the ecosystems of developing and developed nation. Remote monitoring using IoT devices can increase the amount of information the equipment businesses get about their equipment in the field. They can in turn use this information to plan preventative maintenance and repair calls effectively. Remote monitoring can also give equipment businesses more control over the equipment; for example: they can disable the capital equipment remotely if the business customer defaults on payment. This removes the need to employ a collection organization to recollect capital equipment and incentivize the business customer to pay on time. Customer product companies in East Africa such as Sun King (Solar panels) are already deploying this kind of technology in their products. At MDaaS, we are building an equipment-monitoring device that tracks quality of electricity, environment conditions (such as humidity and temperature) and equipment usage as shown in the figure below. This device will help MDaaS schedule preplanned maintenance checks smartly and reduce equipment breakdown across our install base.
Teleconferencing and web based meeting software can improve staff and operator training in these LMICs by removing the high cost of overseas travel for training. Free massive online courses (MOOCs) can be also a useful tool for equipment business to bring their personnel up to speed without incurring significant cost associated with technical training.

5.5: Be Lean and Flexible

Equipment business in developing economics must increasingly take on activities that are not within their core business activities. To maximize productivity and business outcomes, they must run a lean organization that integrates firm activities. Lean
organizations are more flexible and able to adapt to different market/industry conditions. For equipment businesses working in environments with high uncertainty, as is usually the case in many developing countries, flexibility and adaptability are critical to success. Equipment businesses must be also to react and respond to the sensibilities of the customer, however unique customer needs might be. Equipment businesses might need to use different servitization strategies for different verticals of the industry or craft out unique service solutions for private business customers and government customers.

5.6: Target private customers before government patronage

The temptation to go after government customers in many developing countries is great; the deals are usually bigger, have better margins, and offer a greater likelihood of a steady source of revenue for equipment business. The downside of government contracts is that the equipment business will be extremely exposed when there are changes within the government or when there is political instability. This exposure may break small-to-medium equipment businesses in LMICs. We therefore propose that equipment businesses target a base of private customers that they provide and capture value from before extending to government customers. In case of loss of business because of government change, there will also be the private sector to rely upon for revenue. Equipment businesses are also less incentivized to pay bribes when they have other revenue sources as their base beside government customers.
6: Conclusion

6.1: Final thoughts

Servitizing capital equipment goes a long way to making capital equipment available, accessible and affordable for business customers who create value for the end customers. In this thesis, I have discussed the unique challenges many equipment business face in LMIC when servitizing their business there. I have also shown that to extend the gain of servitized business models from HICs to LMIC, we have to rethink and tweak proven servitization models in HICs to fit the economic environment of LMICs. Finally, I offer a framework aspiring equipment business that use when considering servitizing in a LMIC. This framework includes the following key recommendations:

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Table 3: Framework for servitizing in LMICs
6.2: Further research

Throughout the thesis, the focus has been on capital equipment generally without considering how capital equipment differs from industries to industries. Upcoming research can go further by investigating the nuances of each industry with regards to the capital equipment in use within it. This new research can illustrate the depth of each of the unique challenges (discussed in this paper earlier). For example, the Nigerian government has created funds to exclusively supports the power and agricultural industries while there is nothing of such for healthcare industry. This means that it would be easier for the supported industry to get financing with better interest rate than others without the support.

Also, in this paper, Nigerian examples were used more often than any other LMICs. While most LMIC faces the similar problems with capital equipment, the macroeconomic countries in each of these LMICs are unique. New research in each of these countries can dig deeper into how prominent the LMIC challenges discussed earlier are and recommend appropriate solutions to them.
References