



Mobile EdTech solutions and their contribution to
quality education at scale in sub-Saharan Africa.

An implementation suggestion for Girl Move
Academy in Mozambique.

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Dissertation written under the supervision of Professor Filipe Santos

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TITLE: Mobile EdTech solutions and their contribution to quality education at scale in sub-Saharan Africa. An implementation suggestion for Girl Move Academy in Mozambique.

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ABSTRACT: The vast spread of mobile phones across sub-Saharan Africa (SSA) offers great opportunities to tackle the region's learning crisis through mobile educational technology (EdTech). EdTech solutions have been highly effective in long-term pilots, but the learning crisis perseveres. This thesis aims to shed light on primary and secondary EdTech, through an interview-based benchmark analysis and an EdTech adoption use case for Girl Move Academy. GMA supports girls to transition to secondary school in a marginalized Mozambican region. All ventures were ranked in categories, derived from interviews with GMA and Mozambican professionals, according to their suitability to GMA. The analysis results in three main findings: First, an uneven subject distribution exists including a science, technology, engineering and mathematics (STEM) dominance but literacy learning solutions for older students are missing despite high illiteracy. Second, the preferred distribution model for scale is via schools with the help of NGOs as hardware and internet situation in marginalized settings still don't allow for individual adoption at scale. Third, countries greatly differ in their EdTech infrastructure and accordingly attractiveness as an expansion destination.

This thesis expands the research done in mobile EdTech in SSA by providing an overview of the landscape and comparing ventures' business models regarding their contribution to quality learning at scale in SSA.

Building on findings, the thesis gives relevant recommendations for GMA for suitable ventures and features to further look into.

KEYWORDS: Educational technology, entrepreneurship in sub-Saharan Africa, Mozambique, mobile learning, learning at scale, ICT in sub-Saharan Africa, internet workarounds, digital divide.

TÍTULO: Soluções móveis EdTech e a sua contribuição para uma educação de qualidade em escala na África Subsaariana. Uma sugestão de implementação para a Girl Move Academy em Moçambique.

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RESUMO: A vasta difusão dos telemóveis na África Subsaariana (ASS) oferece grandes oportunidades para enfrentar a crise de aprendizagem da região através da tecnologia educacional móvel (EdTech). As soluções EdTech têm sido eficazes em projetos-pilotos de longo prazo, mas a crise de aprendizagem continua. Esta tese apresentará a EdTech no ensino primário e secundário, através de uma análise baseada em entrevistas e um caso de utilização da EdTech para a Girl Move Academy (GMA). A GMA apoia raparigas na transição para a escola secundária numa região moçambicana marginalizada. Os projetos de referência foram classificados quanto à sua aptidão para a GMA. A análise resulta em três conclusões principais: Primeiro, existe uma distribuição desigual de disciplinas com um domínio da ciência, tecnologia, engenharia e matemática, mas nenhuma aprendizagem de alfabetização na escola secundária apesar do elevado analfabetismo. Em segundo lugar, o modelo de distribuição preferido é através das escolas em conjunto com ONGs, uma vez que a situação do hardware e da Internet em ambientes rurais não permite a adoção individual à escala. Terceiro, os países diferem muito nas suas infraestruturas EdTech e, conseqüentemente, na sua atratividade como destino de expansão.

Esta tese expande a investigação feita na EdTech móvel na ASS, fornecendo uma visão geral da situação e comparando os modelos de negócios no que diz respeito à sua contribuição para a aprendizagem de qualidade em escala na ASS.

Com base nos resultados, a tese dá recomendações relevantes para a GMA para empreendimentos e características adequadas para análise mais aprofundada.

PALAVRAS-CHAVE: Tecnologia educacional, empreendedorismo na África subsaariana, Moçambique, aprendizagem móvel, aprendizagem em escala, TIC na África subsaariana, soluções de trabalho na Internet, fosso digital.

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I wish to thank my dear parents Silvia and Veit Oberdieck for supporting and believing in me throughout my academic journey as well as my amazing grandmother Ursula Schmelter. I am grateful to my dear friend Sophia Westermann, working together on our theses in Lisbon has been the outmost pleasure. A big heartfelt thank you goes to my wonderful friends Luisa Stobbe and Viktoria Wagner for their emotional and academic advice while writing this thesis and for visiting parts of Africa with me. And last but not least, I want to thank my great friends Luise Becher and Klaudia Domńska for their enriching feedback on my work.

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LIST OF ABBREVIATIONS

Afcfta	African Continental Free Trade Agreement, 2021
AI	Artificial Intelligence
ASb	African Storybook (Benchmark venture)
AU	African Union
CESA	Continental Education Strategy for Africa by the African Union
CIA	Community Innovation Agent (concept by TheScienceSet)
EAC	East African Community (Burundi, Kenya, Rwanda, South Sudan, Tanzania, Uganda)
ECOWAS	Economic Community of West African States (Benin, Burkina Faso, Cap Verde, Côte d'Ivoire, Gambia, Ghana Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, Togo)
EdTech	Education Technology
EODB	Ease-of-doing-business
ICT	Information and communication technology
GMA	Girl Move Academy (Female empowerment organization based in Nampula, Mozambique)
LDC	Least developed countries by an UN Index: 'LDCs are low-income countries confronting severe structural impediments to sustainable development. They are highly vulnerable to economic and environmental shocks and have low levels of human assets and are therefore frequently fragile states.'
LMS	Learning Management System
OER	Open Educational Resources
PALOP	Portuguese-speaking African countries (Portuguese: Países Africanos de Língua Oficial Portuguesa; PALOP)
SSA	Sub-Saharan Africa
STEM	Science, technology, engineering and math
VR	Virtual Reality
WTP	Willingness-to-pay

I. INTRODUCTION

Sub-Saharan Africa (SSA) is the most economically challenged region in the world. It is widely acknowledged that education is among the top mechanisms to fight poverty and economic inequalities. However, SSA also has the poorest state of education titled ‘learning crisis’ (UN 2019). Of all children in SSA 88% will be illiterate and lack the most basic numeracy skills after lower secondary school, if current learning rates continue (UNESCO 2017a). Even though literacy and numeracy are deemed ‘a fundamental human right’ (UNESCO, 2020a).

Mobile phones are vastly spread across SSA, with almost every second person owning one (GSMA 2020). Since even marginalized citizens have access, mobile educational technology (EdTech) solutions entail enormous potential to close the education gap of respective communities. EdTech could provide 97.5 million unschooled (UN 2019) and 200 million enrolled but not learning children (UNESCO 2017a) across SSA with a quality education. Decades of development work in the region have focused on brick-and-mortar schools. Yet, the learning crisis in SSA perseveres (McKinsey and Company, 2013).

EdTech at scale could lead to productivity gains between 30 to 70 billion USD that governments could use to drastically enhance children’s future perspective (McKinsey and Company, 2013). Without radically different approaches, the future of entire generations will be threatened (UNESCO 2017b). SSA’s population is predicted to double to 2.4 billion people until 2050 (UN DESA, 2019). That makes solving the learning crisis ever more relevant. The COVID-19 pandemic has considerably accelerated the development and global interest in EdTech.

Therefore, the goal of this thesis is to better understand how EdTech works, and what is missing to best support children’s study progress across SSA to tackle the learning crisis. The research focuses on mobile phones, the most wide-spread device across SSA. Mobile EdTech ranges from educative SMS over smartphone apps to virtual reality (VR) solutions powered by artificial intelligence (AI) for personalized learning. The objective of the thesis is to provide answers to the following research questions:

RQ1: What offerings and respective technological implementations exist in SSA for mobile EdTech?

RQ2: What inclusive distribution models are deployed by mobile EdTech ventures in SSA to achieve higher learning outcomes at scale?

RQ2a: How viable is a pan-African Mobile EdTech solution to achieve learning at scale?

To approach the research questions, an overview of the EdTech landscape regarding the above-mentioned aspects is given by comparing 22 EdTech ventures with an interview-based approach. These strongly vary in their product offering to portray the region's EdTech diversity and different approaches to tackle the learning crisis. The main variables of analysis are the educational approach, technological requirements, educational resources, distribution model, revenue and pan-African scalability interest.

Ventures were compared from an already pre-selected pool, chosen for their superior performance by industry experts as finalists from prestigious social entrepreneurship awards in the category education over the past three years like from the Global Learning XPRIZE. Others were awarded by important public organisations like the EU and AU, World Bank, The Mastercard Foundation or supported by the only African EdTech incubator Injini. Several mappings of the field for 2020 such as by the World Bank or by Business Intelligence firms HolonIQ and BriterBridges were compared. The selection was complemented by a comprehensive Crunchbase listing¹ of over 450 African EdTech firms, filtered according to the research criteria of this thesis. Suitable ones were contacted via LinkedIn for an interview.

The same question guide with open-ended styles was employed for the formal expert interviews. The majority of interviewees were CEOs or working in Business Development. Two ventures outside the benchmark and two EdTech industry experts knowledgeable in the region of SSA were interviewed for a different perspective of the challenges. A special interest was the participants' view on what EdTech is missing to reach currently excluded learners across SSA. The collected information was analysed using MAXQDA, employing the qualitative content analysis approach by Mayring.

The third research question concerns the use case of suggesting a suitable EdTech venture for the impact venture Girl Move Academy (GMA) in Mozambique, partnered with for this thesis:

RQ3: What constitutes a suitable EdTech solution for GMA in Mozambique to enhance their educational offering aligned with their mission?

¹ It's called 'Africa Education Companies' sorted by funding for education in the geographical region of SSA. Around 470 companies were filtered according to the research criteria of this thesis (mobile, primary and secondary education, active in SSA, awards/expert recognition).

To obtain a wholistic view on GMA's concept and needs, further expert interviews with professionals from GMA were conducted. GMA is an educational women empowerment impact venture located in Nampula, in the North of Mozambique, one of the least developed countries (LDC) worldwide. Successfully adopting an EdTech solution could lead as an example for other local initiatives in the future. It also proves that the learning crisis can be tackled - even in one of the most challenging areas in the SSA, hardly reached by EdTech. Until COVID-19, GMA had no previous experience employing EdTech. In order to find an EdTech fit for GMA, EdTech mapping interviews were combined with further desk research. As a way of obtaining first-hand information on Mozambique, expert interviews with three local professionals were conducted. Lastly, all benchmark ventures from the previous part were ranked in an excel sheet according to their capability to solve three major challenges in Mozambique and their suitability for the three most valued features by GMA. The campus seems to be the best setup, considering security and the right study atmosphere. As most ventures aren't mutually exclusive, several offer valuable features to enhance GMA's empowerment activities, for GMA's goal of the girls transitioning to secondary school by providing support for the deciding exam or by teaching fundamental academic life skills. Some EdTech ventures will thereby significantly broaden the girls' outlook on life which is highly valuable for change agents.

Overall, the adoption of an EdTech solution for GMA's activities will be mutually beneficial as EdTech is most effective for empowered individuals with aspirations (McReynolds et al., 2020) while quality education will contribute to GMA's mission to uplift the girls and expand their horizon.

II. OVERVIEW OF MOBILE EDTECH DEVELOPMENT IN SSA

2.1 REACH OF TECHNOLOGY AND INTERNET PENETRATION IN SSA

Technology and internet have the potential to democratize access to education in terms of cost, reach and quality (UNESCO, 2019). E-learning solutions transform the way humans learn as they remove limiting aspects such as time and location. Previous global EdTech initiatives, like the One Laptop per Child Initiative, failed because they focused on the wrong hardware. Computers are not compatible with the circumstances in most people in SSA live in. Mobiles, however, are perceived to be ubiquitous in the region (Annan, Ofori-Dwumfuo and Falch, 2014). With their two-way communication, mobiles are powerful means of opening up learning

to those who might otherwise remain at the margins of education (World Bank, 2020; Kukulska-Hulme, 2010).

2.1.1 Mobile phones

Two types of mobiles employed in EdTech will be presented, their level of adoption and prevalent adoption barriers. Understanding adoption patterns is essential to avoid unintentionally excluding some children from quality EdTech solutions.

In 2019, 816 million active SIM cards were registered across SSA (GSMA, 2020). Those promising figures are commonly mistaken with the mobile phone penetration rate which indicates how many people actually own a phone as it is common in SSA to have several SIM cards. While a 45% mobile phone penetration rate includes a large part of the population, it's significantly fewer people (477 million) than SIM cards active (GSMA, 2020)². Another misconception is that the vast spread of mobiles refers to smartphones, but feature phones are referred to (IDC, 2020). A basic feature phone usually has a simple browser, media player but no WIFI access and doesn't support apps due to limited processing and storage capacity (World Bank EdTech Team, 2020; Adepoju, 2019). Smartphones use iOS or Android hence are compliant with more advanced EdTech solutions (ITU, 2020). Their touchscreens open up new learning opportunities in particular for young or illiterate learners as the requirement of literacy and keyboard knowledge for EdTech usage can be surpassed (Muianga et al., 2019).

There is an uneven distribution particularly for smartphones within and across countries in SSA (Wiseman and Turner Johnson, 2019). In rural areas, mobile adoption is much lower, and smartphones are rare as a contrast to cities, in particular capitals (West et al., 2014). SSA's subregions are more aligned in terms of smartphone share of total connections. With a mid 60% smartphone adoption by 2025, all will experience drastic growth of around 20% in less than five years (GSMA, 2020). The top three markets for smartphone connections in SSA – namely Nigeria, South Africa and Kenya – will continue to have the highest adoption in 2025 (GSMA, 2020). This explains why many founders focus on smartphones, stating to be 'building for the future'. However, outside SSA's main tech hubs, smartphone adoption is and will remain low beyond 2025, particularly in rural regions, with a third of the population excluded (GSMA,

² It is common in SSA to own several SIM cards to avoid poor network reception by one provider (Umeh, 2019).

2020). A smartphone requirement of an EdTech solution leaves out entire year groups causing in the short-term further educational inequity.

The main adoption barrier cited for smartphones is affordability (GSMA Connected Women, 2020). Though prices are continuously decreasing due to cheap Chinese brands, selling smartphones below 100 USD and Pay-as-you-go financing schemes (Broadband Commission for Sustainable Development, ITU and UNESCO, 2020b). Nevertheless, there remains an estimated 50% difference in price between the most low-priced smartphone and a feature phone (ITU, 2020). Many marginalized people don't know the advantages and usage of smartphones, not triggering adoption (GSMA Connected Women, 2020). All they see is the high price and complications such as data cost, higher battery need, shorter life expectancy and risk of robbery (GSMA and EQUALS, 2019). Due to the poor spread of Information and communication technology (ICT), the very poor level of digital literacy is the second most restricting barrier (GSMA Connected Women, 2020).

2.1.2 Internet

'With internet, the question of access to education shifts from a spatial location of the space towards the affordances and constraints of the virtual learning environment' (Rambe and Mawere, 2011).

Mobile phones are by far the most important mean to access the internet in SSA, making up 87% (ICT, 2017). Digitization is currently progressing rapidly in Africa which makes internet access seem like it's omnipresent but it's not: mobile internet users present only about the same percentage as those without broadband access namely 26%, which equals 272 million people (GSMA and EQUALS, 2019). Also, there is national disparity as half of the 130 million first-time mobile internet users by 2025 will be from the same five countries³ namely: Nigeria, Ethiopia, DRC, Tanzania and Kenya (ITU, 2019).

In SSA to date, 25% of the population (262 million people), are not covered by a broadband connection. However, almost double the number of citizens (49% equal to 512 million) live in an area with internet penetration but are not using it (GSMA and EQUALS, 2019). That shows that micro-economic and cultural barriers also strongly apply to internet access (GSMA Connected Women, 2020; Research ICT Africa, 2019). Also, the lack of broadband connection issue is decreasing with mobile operators as well as the tech giants Facebook and Google

³ out of 49 in SSA

increasingly building broadband infrastructure (Kazeem, 2019). Triggered by COVID-19 in 2020, a commitment to investment 52 billion USD by public institutions until 2025 was made (Broadband Commission for Sustainable Development, ITU and UNESCO, 2020b).

Many blended ventures with creative internet workarounds exist, as most citizens in SSA access the internet for minutes rather than unlimited (World Bank EdTech Team, 2020). That reduces the pain point of high mobile data cost, the principal affordability challenge. Many citizens in SSA can nowadays afford an internet-enabled phone but not data (Broadband Commission for Sustainable Development, ITU and UNESCO, 2020b). In relative terms, Africa has the highest mobile data costs worldwide: Spending 2% of the Gross National Income per Capita for 1GB of data is the affordability target, but across Africa it's 6,4% (ITU and Alliance for Affordable Internet, 2021).

This led to the rise of zero-rated apps which means that telecom operators exempt applications for their users in a country from data charges. During the pandemic, mobile operators in cooperation with universities across SSA supported online EdTech ventures by waiving fees and implementing zero-rated access for university students (GSMA, 2020). Benefits offered across eight countries included 10 GB data bundles for online learning and free access to thousands of books on a digital library (GSMA, 2020).

Internet access remains a privilege, which must be considered for EdTech to not deprive at least five more cohorts of a quality education.

2.2 MOBILE EDTECH SOLUTIONS IN SSA

2.2.1 Envisioned Integration of EdTech

EdTech aims to improve learning outcomes by transforming education, not by eliminating but Development, ITU and UNESCO, 2020a). Schools, currently not even able to offer basic textbooks, could provide students with worldwide leading educational content through EdTech (McKinsey and Company, 2013). Therefore, the giga initiatives strives to connect all schools in SSA to the internet until 2030 (Broadband Commission for Sustainable Development, ITU and UNESCO, 2020a).

The vision of the African Union (AU) outlined in their Continental Education Strategy for Africa (CESA) is to reform the teaching profession while emphasizing its relevance within African societies (African Union, 2019). A focus shift from content acquisition teaching to practical, creative and social skills teaching with the teacher as a guide is planned (Broadband Commission for Sustainable Development, ITU and UNESCO, 2020a). Maintaining teachers to set and uphold norms and expectations in schools is essential which must be incorporated into EdTech solutions (Dillenbourg and Jermann, 2013; Holstein, McLaren and Alevan, 2018). Moreover, teachers assist students with the acquisition of new knowledge through EdTech better and complementary to peers (Pea, 2004). They also greatly support with digital literacy learning (Pea, 2004). Furthermore, they can evaluate students' learning stage and guide them to more challenging tasks if required (UNESCO, 2017b). In EdTech pilots, this was often needed as independently studying students didn't move on without external intervention (Uchidiuno et al., 2018).

Rwanda strives to transform their economy through EdTech by leveraging ICT in education using a concrete, ongoing transformation plan, leading in the region (Republic of Rwanda Ministry of Information Technology and Communication, 2017). Schools will function as open digital hubs equipped with ICT devices to strengthen digital inclusion, further develop digital literacy and to enhance the digital transformation from a pedagogical perspective (Oppen, 2019; UNESCO, 2020a). Specifically, nationwide platforms containing curriculum-aligned study content will be set up for blended learning models (Republic of Rwanda Ministry of Information Technology and Communication, 2017). Support will be given to teachers in ICT skills adoption for pedagogical use and to enhance digital literacy among students through them (Wallet et al., 2019; Republic of Rwanda Ministry of Information Technology and Communication, 2017).

Regarding subjects, the prime goal of the AU for EdTech is to eradicate illiteracy and drastically improve STEM teaching and its importance in African societies (African Union, 2019).

2.2.2 Learning Outcomes Pilot

Many EdTech ventures only state impact metrics like learners reached while few formal, large-scale EdTech studies for learning effectiveness in SSA have been conducted (McReynolds et al., 2020). Improved exam performance for content-acquisition through a mobile app with micro-learning units and a respective micro-assessment was proven effective (World Bank

EdTech Team, 2020). For primary STEM education, a significant positive impact on student learning performance, motivation and attitude could be proven with gamification (World Bank EdTech Team, 2020).

In a landmark study concerning size, duration and setting in rural Tanzania for basic literacy and numeracy, all five participating ventures' learning scores dramatically outperformed the control group, by 2-3 times (McReynolds et al., 2020). Learning outcomes per student varied drastically though (McReynolds et al., 2020). Various factors such as gender or parents' education were tested for, but the only one significantly predicting higher gains was 'Aspirations' (McReynolds et al., 2020). This was measured by asking children about their profession dreams⁴ (McReynolds et al., 2020). Those envisioning a profession requiring literacy, significantly outperformed those without, underlining the importance of social-emotional support for learning outcomes (McReynolds et al., 2020). The study will be used as a proof-of-concept underscoring EdTech's potential to enhance learning outcomes of public schooling in SSA (McReynolds et al., 2020).

2.2.3 Funding, Market and Ecosystem for EdTech in SSA

There are various highly promising EdTech solutions to tackle the learning crisis, but they lack significant scale due to a shortage of suitable financing methods (UNESCO, 2017a). Public domestic funding remains the main source for education (Mastercard Foundation, 2020). Governments across SSA fulfil benchmarks for educational spending but don't spend it on tech (Mastercard Foundation, 2020). Many are interested but unsure which EdTech solution to choose (Mastercard Foundation, 2020).

The pandemic has disrupted traditional offline schooling everywhere by accelerating the usage of digital learning (Wani, 2020). Globally, investments almost doubled within a year due to the pandemic (Bouhaj, 2020). However, less than 20 EdTech ventures in SSA raised funding (Bouhaj, 2020). SSA's EdTech market still is at an early stage with most investments going into 'Seed' and 'Early stage' ventures, but it's growing (JET Education Services, 2019): a rising number of VC firms invest increasing amounts into EdTech ventures with a 36% CAGR over

⁴ The Social-Emotional Assessment used a structured face-to-face questionnaire with the child and their parents.

The question concerned children's future career aspirations by asking (in Swahili), 'Please tell me when you grow up, who would you like to become?'

the past five years (Bouhaj 2020). But compared to other tech fields in SSA, there have been little investments into EdTech (EdTech Diggist, 2020). There are investments into EdTech, but it's not nearly sufficient to tackle the learning crisis at scale with a sum of only 31.8 million USD in 2018 (JET Education Services, 2019; International Development Research Centre, 2018). For inclusive secondary education including for the most marginalized, focused equity-based financing is required (Mastercard Foundation, 2020).

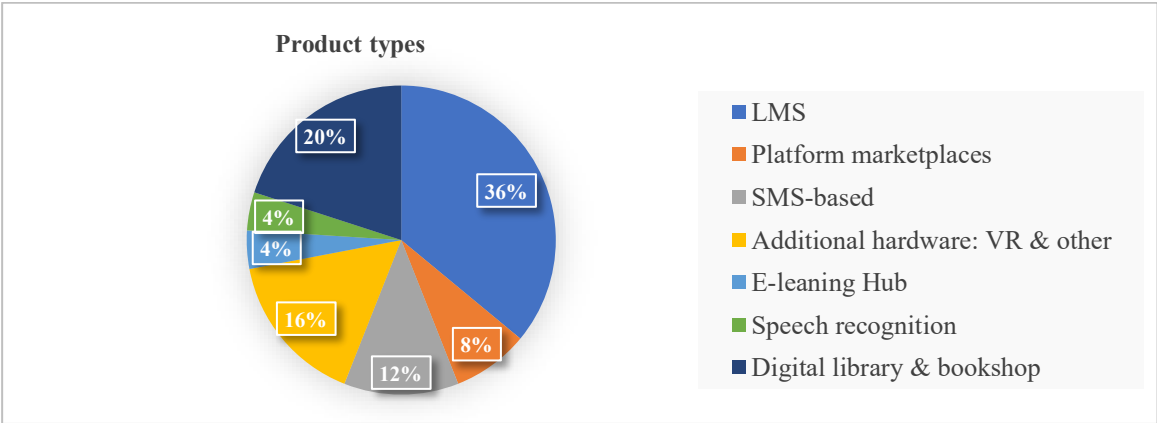
Support structures for entrepreneurs in the region are very much needed (McKinsey and Company, 2013). They are emerging now in the form of one EdTech incubator in South Africa, reporting strongly increasing numbers of applications,⁵ as well as various general tech hubs and angel networks providing hope to the region (Injini, 2021; International Development Research Centre, 2018). Due to its scope, the learning crisis can't be tackled on national level but through regional integration (Kararach, Hanson and Léautier, 2011).

III. BENCHMARK OF EDTECH VENTURES FOR LEARNING AT SCALE IN SSA

For this industry research study of mostly private sector approaches, 22 ventures were interviewed analysing how they enhance the reach and quality of education in the following five categories: product overview, educational resources, technology, distribution model, revenue and scalability potential.

3.1 PRODUCT OVERVIEW

There are five main product types in the benchmark: 1. Learning Management Systems (LMS), 2. Platform marketplaces, 3. SMS-based learning, 4. Additional hardware, 5. E-learning in physical spaces.



⁵ From over 100 applications in 2017 to over 800 in 2018

Figure 1: Overview product type of benchmark ventures

1. There are many **LMS** in the tech hubs of SSA (primarily Kenya, Nigeria and South Africa and others upcoming in the EAC and ECOWAS). They offer the IT, structure and setting to organize educational content. LMS mostly offer curriculum-aligned content for all subjects and year groups as schools are the prime customers and want all students and teachers covered. In order to ensure desired learning outcomes for each lesson are achieved, LMS often explain the learning goals at the beginning and ask the student to tick the goals they fully understood at the end (IDEA). If one box is not ticked, the student will be forwarded to the problematic section to revise it. Students can also do exercises on the platform which AI corrects according to the teacher's sample solution (Gradely, Clique, IDEA). AI takes over repetitive correction workload from teachers for pure content acquisition tasks. It evaluates the student's areas of strength and for improvement for each topic on the student's dashboard. Accordingly, teachers can follow AI's personalized suggestions or look themselves into supporting exercises and video lessons to be assigned to the student in the area of improvement. Thereby, they enhance the quality of lessons by allowing teachers to use their time more efficiently. The focus can shift to personal support or practical tasks.

Another venture relies on the students, to report their learning gaps as it works offline (PaperVideo). Next to each question, students find a QR code to scan when they struggle. It leads them to support material for the overall topic (conceptual level) as well as to more questions for the specific question area starting with easier ones first (revision level), both stored on a micro-SD card. For LMS usage with AI features, learners need an internet connection, but blended versions are possible too, as learners can upload their results when the internet is available again. As LMS are advanced programs, a certain level of digital literacy is required. Accordingly, the minimum hardware requirement is a smartphone.

Regarding LMS design, the former teacher and founder of Examsta, Marie de Wet, states that many ventures have too many distractions as well as too much content in a video format, which lowers students' attention span and makes them passive. Students are afterwards mostly unable to properly formulate their exam responses as they didn't study to respond in a written format (Examsta). A very simple navigation avoids animating gamification and resulting distractions for users and makes their study session more effective.

2. Platform marketplaces are popular for individual tutoring solutions in SSA's tech hubs. They match tutors, mostly former teachers, with students needing help in a subject. They target individuals with a certain Willingness-to-pay (WTP) for education (Clique, Maarifasasa, Gradely). Ventures offer digital tutoring and group live sessions (Gradely). Learners need to have a stable internet connection for digital tutoring; hence workarounds or blended versions are impossible. The minimum hardware requirement is a smartphone and therefore a certain level of digital literacy is needed.

3.SMS-based ventures send basic, standardised explanations of important curricular topics to students upon request via SMS. Some offer a questions and answer format where teachers respond to questions instantly. Respective programs don't require internet access and work well with feature phones. They require only a basic digital literacy which the majority of the population, even in marginalized areas, has (Eneza, Mtabe and MLesson). Therefore, they are compatible with off-grid settings.

4.Additional hardware makes educational content presentation more animative. Respective benchmark ventures employ VR goggles (Maarifasasa, OwnLabs) for biology and chemistry. The promising VR goggles seem to be exclusively used for STEM, even though other subjects could be equally-well presented by it. VR goggles can enable students to see things that aren't possible in real life. Examples for biology and chemistry are a tour through the human digestive system or experiments that are too dangerous to be conducted in class (Maarifasasa, OwnLabs). This methodology significantly decreases the abstractness of those subjects and triggered tremendous excitement for STEM subjects among students and teachers participating in pilots. Due to a high price, VR goggles are exclusively used for B2B via schools. STEM graduates are highly sought after by the private sector; hence they might offer potential funding opportunities for the pricey solution which could explain STEM as the chosen subject for VR. A competitor offers a much cheaper set for physics with instructional videos (TheScienceSet). The venture considers their physical approach important for learning. Only respective explanatory videos require a smartphone, but blended videos can be downloaded. A certain level of digital literacy is needed. Due to low ICT requirements, STEM solutions are equally relevant for marginalized settings as they are for affluent ones to improve STEM education. Others provide tablets with their software preinstalled and other applications blocked (RoboTutor). One venture uses a large audio speaker for teaching in class (Chasing2Rabbits) which is suitable for marginalized settings, introducing basic ICT.

5. Outside schools, LMS are employed in **E-learning hubs** (Maarifasasa), often funded by NGOs. Physical spaces are often used to reach the most marginalized who can't afford ICT requirements of EdTech solutions (Maarifasasa). The digital literacy requirement is often incorporated for by providing respective training. E-learning hubs often offer blended support—through LMS and through a present teaching assistant knowledgeable in the subject (Maarifasasa). The group study atmosphere of a physical space further motivates which is a key challenge for e-learning. A timetable predefines when subjects are offered. Every student can study at their own speed and further go into their personal areas of struggle. Lastly, some utilise a combination of products varying in ICT requirements as it allows them to reach different groups of learners (Maarifasasa).

To conclude, while many product types try to enhance learning outcomes through personalization it will depend on the determination of the student to improve by e.g. reporting problems in a section. Therefore, keeping students' interest and motivation up through an interactive and illustrated content presentation is very important (IDEA). However, it also shouldn't be too gamified and be clear it's a lesson (Examsta, IDEA).

3.2 EDUCATIONAL RESOURCES FOR LEARNING AT SCALE

3.2.1 Subject Range

In orientation to sector mappings, the benchmark can be structured into five subjects⁶: 1. Tutor marketplaces and specific exam preparation, 2. School-accompanying curriculum-aligned, 3. STEM subjects only, 4. Basic literacy and numeracy learning and 5. Digital libraries and bookshops. The categories are not mutually exclusive and differ vastly in their scope of content offered, content presentation methods applied, skills taught, academic learning potential and impact potential for transformative power on life.

⁶ On the basis of maps by market intelligence firms and VCs such as BriterBridges, HolonIQ, Worldbank, excluding coding as it requires computers

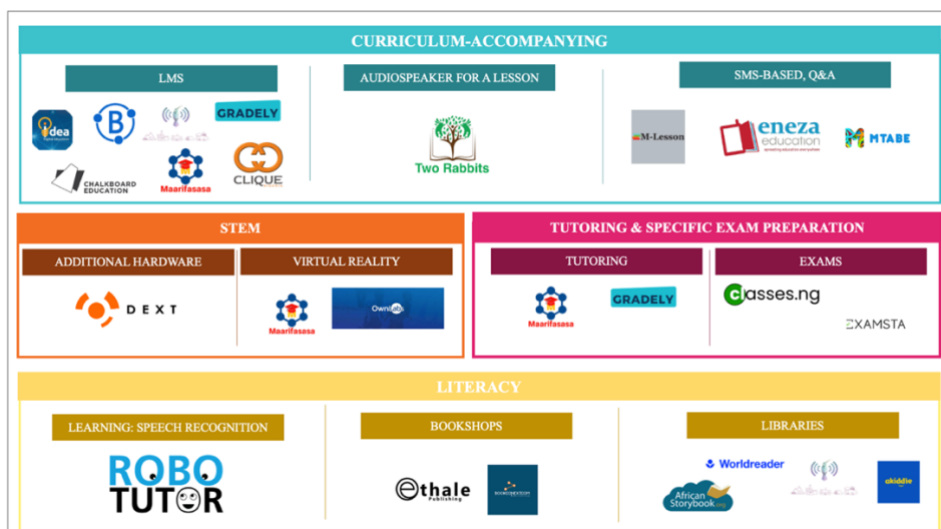


Figure 2: Overview product and subject offering of benchmark ventures

1. **Tutor marketplaces** include some study materials, but the educational outcome mainly depends on the individual tutor and the relationship to the student. Outcomes vary greatly. Tutors are often former teachers, carefully selected through interviews. Goals of tutoring are mostly limited to passing specific exams leading to a degree or certificate (ClassesNG) rather than improving learning outcomes. In South-Africa for example, the national final exam failure rate is very high at over 20% despite 60% of the exam consists of pure content acquisition tasks. As only 30% are required to pass (Mail & Guardian, 2020), with the right preparation every student could pass, without outstanding cognitive abilities. Therefore, one venture offers specific exam preparation focusing on the content acquisition tasks for students in need to pass rather than excel. The methodology is called ‘spaced repetition technique’, which allows learners to review content at systematic intervals to achieve long-term learning (Examsta). Smartphones are required but without data requirements as it is zero-rated (Examsta).

2. Many **school accompanying solutions** serve primary education only even though the most pressing issue in SSA is secondary school enrolment. School-accompanying solutions are aligned with the national curriculum, with a strong focus on core subjects particularly STEM but officially, most provide all subjects. This is because schools expect a comprehensive solution.

3. Many ventures believe **STEM subjects** are the ones to focus on with high demand as they are perceived as difficult (PaperVideo, Examsta). However, exactly because of that, the majority of students elects higher level subjects other than STEM (Examsta). They rather opt

for content rich subjects in social sciences and arts with more variations in international curricula for which hardly any EdTech solutions exist. Social sciences are not as focused on achieving a clear result as in STEM, therefore require more visual representations and discussions which makes them less amenable to short videos and more resource intensive (PaperVideo).

4. There are various solutions for **basic literacy and numeracy** including one the benchmark using speech recognition with drastic learning efficiency proven (RoboTutor). The solution continuously corrects students' mistakes by reading out the parts they read wrong and offering special practise intervals (RoboTutor). However, all literacy learning solutions researched, regardless the method, seem to target very young learners with puerile designs. EdTech ventures don't consider that the majority of students beyond lower secondary school is illiterate in SSA.

5. It is common knowledge that **reading** on a regular basis helps literacy skills and cognitive improvements. Poor infrastructure made the distribution of books in certain regions of SSA close to impossible, leading to book prices the majority of the population couldn't afford (Ethale). Now, various digital libraries and online book shops offer e-reading compatible with feature phones (Ethale Publishing, Bookconekt, African Story Book Initiative, Akiddie, Worldreader). E-books caused a price drop by up to 90% (Ethale) which could make books a mass market product and enhance literacy at scale.⁷

Summing up, social sciences and arts are disproportionately underrepresented and for others there are starkly varying degrees of content depth and solution design depending on the product. Limiting subject range, prevents students from advancing in their area of interest, or their interest might never even get triggered due to a dull product design.

⁷ Okada.books in Nigeria was mentioned as an inspiration by Akiddie, atingi and Ethale as the most well-known digital bookshop on the continent, selling 150k books per day and fighting illiteracy in doing so.

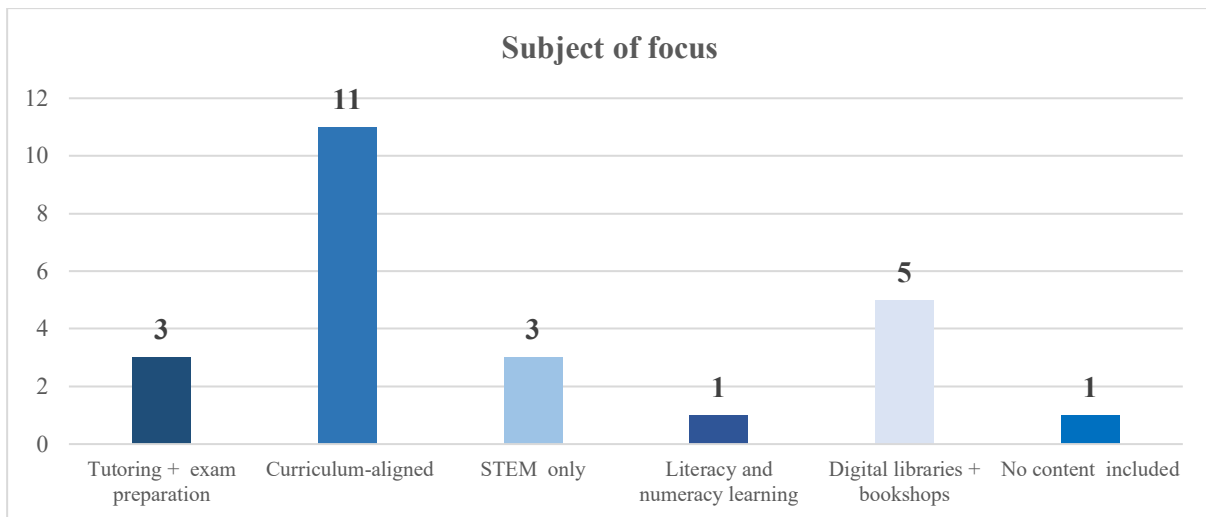


Figure 3: Overview subjects of benchmark ventures

3.2.2 Content Localization

To reach more people, users must be able to refer to the solution personally therefore content, examples and illustrations must be adapted to the local cultural identity (atingi, IDEA, RoboTutor). In order to do so, many partner with local teachers, as freelancers for operational tasks or as team members who are also involved in strategic decisions. Numerous ventures have a base of curriculum-agnostic material in which local adaptations are made by teachers (PaperVideo) or a regional expert team for larger players (Worldreader). One venture offers a freely available curriculum alignment tool to support teachers and curriculum designers in adapting learning resources to different national curriculum (Kolibri). Their method strongly triggered organic adoption in various countries.

3.2.3 Language Choice

Africa has the most languages worldwide. Nevertheless, the vast majority of EdTech solutions seems to be in two languages: French and English. Some ventures interviewed thrive to next offer Arabic, then Portuguese followed by important African languages like Swahili. Their order follows the number of speakers ranking of official languages in SSA.

However, those statistics don't count maternal speakers but citizens according to the official language spoken in their home country. Teaching in the official national language drastically reduces learning outcomes as students often simply don't really understand the content (IDEA). A minority of students, like some indigenous populations, often don't understand the official language at all (Chasing2Rabbits). The majority, however, has a mediocre proficiency in the

official language. Therefore, experiments with blended versions are starting to rise having a promising start (IDEA). Only one benchmark venture serving a highly marginalized indigenous population, translates content into the local language done by a team of community members and linguists. However, they also include lessons and study material in the official language, to enhance the proficiency of the indigenous population in it but not at the sake of missing out on curricular content (Chasing2Rabbits).

All other ventures use the official language, arguing that in order to pass high school, students need to have a sufficient proficiency as exams are in the official language. Also, specific terms such as in Biology often don't exist in many local languages.

According to Filipo, the most feasible solution seems to be to choose the language of instruction and additionally the regional African giants. He considers it important to look at it from a regional rather than national or pan-African perspective. Research has shown that the language barrier has been one of the major contributors to the poor learning outcomes in SSA (Ayorkor Korsah et al., 2010). Yet, EdTech runs the risk of continuing the mistake.

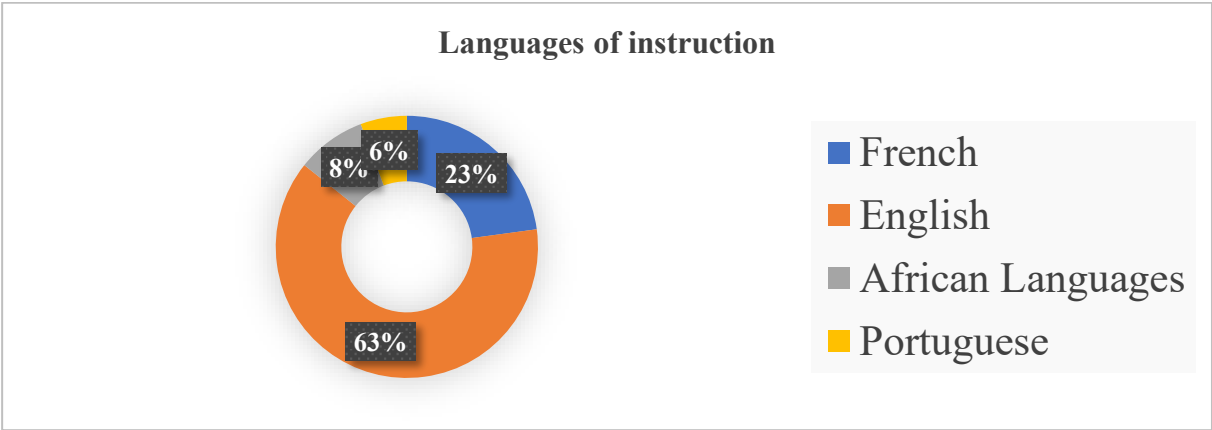


Figure 4: Overview language of instruction of benchmark ventures

3.2.4 The Role of Teachers

Forecasts for education with digitization see teachers' role in EdTech changing but remaining very relevant (Opper, 2019). Founders without an educational background, but a strong tech focus often underestimate the importance of choosing high quality content and skilled teachers (Examsta). Comparing the funders' academic background, the majority had a business or technology background. Only one venture, namely Examsta, was founded by a teacher.

However, while some founders state receiving content from some local teachers should be easy and quickly done, many founders put a lot of effort into it, regarding quality content as a core part of their value proposition (Maarifasasa, Gradely).

All ventures agree that for their content development teachers previous teaching experience is essential. As team members, some ventures prefer inactive teachers as they also have experienced certain pain points in schools that made them stop teaching and wanting to change the status quo. Others prefer freelancers who are still actively teaching as they are up to date with changes and trends. Also, they have to create their own material anyway and the option to do some good with it compensates low salaries for them. However, ventures agree that great teaching skills and experience aren't sufficient to become a team member- a certain level of tech savviness is required. Most teacher collaborations happen with professional content developers (PaperVideo, IDEA) or with renowned teachers from the best national private schools (Maarifasasa). Thereby, they democratize access to high-quality education (Maarifasasa).

3.3 TECHNOLOGY FOR LEARNING AT SCALE

3.3.1 The Role of Mobiles

A mobile acted as a principal communication tool for administrative matters between teachers and parents. During the last four years, its purpose changed to a more educational usage for study materials and as an e-reader (Worldreader). Everyone interviewed agreed that nowadays, feature phones are of extreme importance for EdTech ventures to reach scale in SSA. Many digital libraries employ mobiles for delivering their programs (Worldreader). In addition, audio books consumed via feature phones are gaining popularity (Ethale). Besides, one venture perceives a growing trend in home schooling (Maarifasasa) for which mobile EdTech solutions are highly relevant. In terms of material for curriculum-aligned solutions, everything is nowadays accessible via mobile phones (BrainShare, Examsta, Clique). Only for the practical side of STEM, mobiles don't seem to be particularly compliant. One venture paired Google cardboard with students' smartphones, but the quality of VR was very poor even with smartphones and learners frequently broke the cardboards (OwnLabs). Therefore, they switched to Facebook Oculus glasses for VR that require neither a phone nor internet access (OwnLabs). More on apps in *APPENDIX 1*.

3.3.2 Internet: offline vs. Online debate: Blended ventures

To reach scale across SSA and enable regular study session, EdTech solutions need to be available offline or at least provide internet workarounds (atingi). Most ventures interviewed, have blended versions in place that allow for changes which is important in the agile tech world as well as in education with frequent adaptations. Also, they allow for rich content and wide reach while personalization features are limited as data collection is difficult, also a challenge to measure impact needed for funding. Methods applied are listed in the *APPENDIX 2*.

3.3.3 Coders

The lack of coders needed for the EdTech venture's software development, particularly at senior level and in the LDC, is one of the major challenges. Hiring them from abroad can cause enormous bureaucracy struggles and costs as in many countries no clear laws on 'IT import' exist. The available coders usually demand salaries on a European level while revenues in SSA are far from it. As a consequence, many ventures employ too few coders leading to issues with their platform, user complaints and trust loss (Chalkboard).

3.4 DISTRIBUTION MODELS FOR LEARNING AT SCALE

According to the Global XPrize Education Committee:

'We have the technology and the solutions, now we just need to put them in the hand of children everywhere.'

In the following, the distribution models of the ventures will be analysed, focussing on their challenges to offer learning solutions at scale.

3.4.1 B2B to schools

In marginalized settings, schools often buy the solution on behalf of the students and provide it to them for free (Worldreader, PaperVideo, Maarifasasa, Gradely). SMS-based solutions promote but don't distribute via schools as one venture tried but failed in Ghana and Kenya. Also, schools provide great partnership opportunities as in the case of the e-learning hubs by Maarifasasa. The hubs are often set up together with and run by local schools, bringing costs down and making them sustainable. However, many schools have high expectations wanting a LMS for all subjects, age groups, administrative tasks and including a teacher platform. Without

it, solutions don't even get considered, as schools want them to be the channel for all digital aspects (Examsta, Gradely, IDEA, PaperVideo). Even though experience has shown that for instance teachers don't even use teachers' platforms (Eneza, MLesson). A challenge is the long-term planning needed as it takes at least until the next school year before a solution can be adopted (Examsta).

Another major challenge are the various layers of decision makers at schools including the management and the pedagogic board (Clique, PaperVideo, Chalkboard, IDEA, TheScienceSet). In countries like Ghana where private schools need to be sponsored by a public school, a venture has to do the process for both schools. The decision process can involve up to 120 people - everyone can block the sales process at any time (Chalkboard). While schools often like LMS, the decision making takes very long or even gets lost in bureaucracy (Clique, IDEA). Overall, it requires massive manpower on the sales side, which is difficult even for a medium-sized player (Chalkboard). It constitutes a huge entry barrier and limit to growth for a start-up (Chalkboard). Only corporate giants such as Microsoft manage to go around it by signing framework partnerships with the ministry (Chalkboard). Hence many ventures sell their solution instead to NGOs, who will then deal with the bureaucracy (Chalkboard). Others get CSR departments to purchase their solutions or a one-year subscription on behalf of schools (BrainShare, Eneza, OwnLabs).

At least pre-COVID, schools lacked the right infrastructure and mindset to adopt an EdTech solution (MLesson, BrainShare). Across borders, there is a prevalent technology resistance among teachers, mostly caused by their own low digital literacy (IDEA, MLesson, Eneza). They lack the knowledge to integrate the program into their lessons, don't grasp the benefits for themselves and just see the initial extra workload of getting familiar with the program. This is problematic as adoption happens through teachers but particularly in marginalized regions, teachers adopting a solution independently rarely ever happens (PaperVideo). Even when a solution is purchased, true adoption never happens unless EdTech personnel (usually former teachers) constantly supports the process (IDEA, PaperVideo). Hence some ventures feel, they are rather selling a course for teaching with technology rather than SaaS (PaperVideo, IDEA). An approach implemented by IDEA is a 'digital transformation program' for non-tech-savvy schools, including a teacher champion supporting others with the usage of their software.

3.4.2 B2G

Many ventures complain about the stereotypical challenges with governmental bureaucracy, especially in light of rapid changes happening in EdTech (IDEA, TheScienceSet). The ventures involved in B2G consider it nevertheless the best option to reach EdTech at scale due to the government's power and financial means (TheScienceSet, Worldreader, OwnLabs, IDEA).

3.4.3 B2B to NGOs

Many ventures decided to sell mostly to NGOs rather than universities and schools (Chalkboard education, Robo Tutor, Eneza, Mtabe) as they are better funded and organised and have a proper procurement process in place. Also, often pre-existing relationships between the local school and the NGO simplify engagement of the school and to get through all decision layers. It's important to keep in mind that decision makers of NGOs are mostly in the western world and not best contacted at NGO's African offices.

3.4.4 B2B2C

Schools are considered vital partners as they have access to EdTech ventures' target users all day and can recommend them to adopt certain learning platforms (BrainShare). According to Examsta, most ventures sell via schools, but penetration remains low, without a profit. One reason is that most children are unresponsive in informing their parents about educational material they could buy (Examsta) and it adds an extra layer to the already complicated buying process. Nevertheless, some solutions employ a B2B2C approach (BrainShare, Gradely, Worldreader) directly via the parents. Some sell a basic LMS to schools and in addition they offer the parents a subscription on the same platform for extra content and tutoring (Gradely). Schools often receive a commission for helping with adoption and overcoming initial trust barriers among parents (Worldreader).

3.4.5 B2C

From my sample, few ventures offer solely B2C but rather employ both B2C and B2B via schools or NGOs. Some ventures only do individual distribution in urban contexts as it doesn't pay off in highly marginalized ones (PaperVideo). Others plan on publicly releasing their app on the Google Play Store (Clique, Classes NG). Digital libraries and bookshops for profit

mostly have an individual adoption sales approach (Bookconekt, Ethale) while their NGO equivalents often go via organizations (Worldreader, Kolibri).

With B2C, there is the complication of the child being the user but the parent being the buying customer. Most ventures target the parents directly, while a few ventures (like Mtabe, PaperVideo) consider the child as a lead generator instead. They are dividing their sales efforts equally between parent and child as they believe nothing sells better than the child asking their parents for educational material of their interest. When interviewed about potential concerns that parents might have about their children switching to technology for education, no venture nor the Mozambican professionals had experienced any tech resistance among parents concerning the usage itself. Parents are happy for their children to advance academically through whichever means possible. However, they need to be informed about what their children are doing and how the technology contributes to their learning progress (Examsta). Therefore, some LMS integrate the parents, by allowing them to track their child's progress online (IDEA, Gradely). One venture even involves parents into their solution due to the home-schooling responsibilities parents have due to COVID-19 (Eneza). In general, home-schooling is trending in SSA, even pre-COVID (Maarifasasa).

3.4.6 Distribution to the very marginalized

Most ventures claim their goal to be to reach all children, including the very marginalized communities. However, the true target users of a venture can easily be defined (Filipo) by examining the venture's pricing, hardware choice, internet requirements and adoption support for low digital literacy users. If EdTech solutions exclude the marginalized, as many very tech and future-oriented do, EdTech runs the risk of further pushing them to the brinks of education, increasing the divide rather than closing it. While ICT is soaring, 'Digitization and organic adoption don't simply just happen as the magic solution to everything but need to be steered' (Gradely and atingi). Support must be given as SSA faces many challenges other regions don't face.

Also, certain parts of SSA are still at a very early stage of digitization that many tech-advanced solutions don't incorporate for as the following example shows (atingi): in a pilot conducted in a Tanzanian village, users didn't manage to sign up and log in (RoboTutor), mostly due to being illiterate and having no digital literacy. Hence the venture implemented a workaround that asked users to take a selfie. Then the selfie of the respective user together with audio

instructions and visual explanations were used to show users how to log in. Now children continuously created accounts, as they enjoyed the selfie function so much which overstrained the system. The venture solved this through an extra fun selfie function. To conclude, local pilots, especially for ventures from abroad are key to create the needed product.

Another key barrier before organic, individual mass adoption in marginalized regions can happen is that there is a massive initial investment required: to overcome trust issues especially with digital payments (Olenvo, Gradely, Classes NG), tech resistance, high illiteracy (which prevents any usage unless well-piloted workarounds are in place), lack of the most basic digital literacy (MLesson) and to completely transform education with methods many users have never seen before.

Filipo believes that for many EdTech ventures in SSA, individual organic adoption particularly in rural areas isn't their goal. For the time-being, the majority of socially oriented ventures aims to achieve large scale adoption through schools and governments (RoboTutor). Marketing measures employed for each distribution type including for highly marginalized settings to reach adoption at scale are listed in *APPENDIX 3*.

3.5 REVENUE MODELS TO FINANCE LEARNING AT SCALE

The grand majority of ventures interviewed with a B2C model relies upon a large userbase to reach financial breakeven (Clique, ClassesNG, Gradely, BrainShare, MLesson, Mtabe, Worldreader) - especially those with very low-price margins targeting the marginalized. Many rural villages are often in great need for an educational program, however, due to the small number of children and teachers it's often not feasible (Chasing2Rabbits, PaperVideo). One venture sets up local sponsoring for schools in marginalised areas through schools' often already existing support networks with e.g., local hardware stores, grocery shops and their community's church (PaperVideo). However, to reach the marginalized, a tremendous amount of funds is required as well as for a large userbase which creates a significant risk for an EdTech firm.

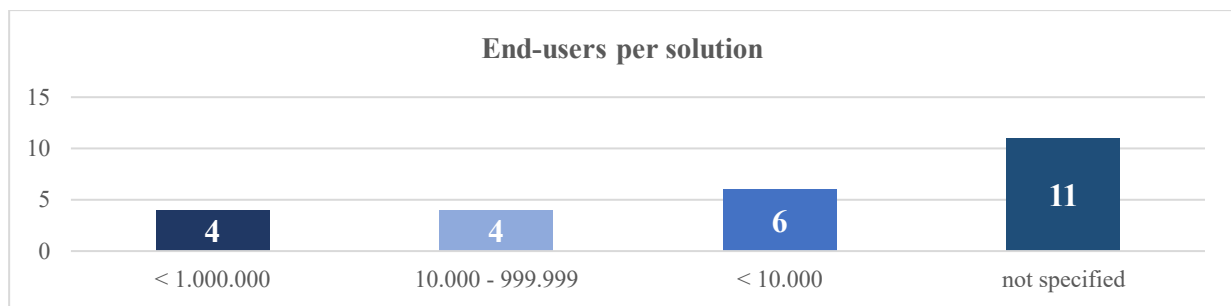


Figure 5: Overview number of users of benchmark ventures

However, receiving private funding is tremendously challenging (Akiddie). African investors prefer to make tangible investments in traditional industries (Akiddie). Local tech investors have only begun to invest in technology in SSA, adopting expectations of Silicon Valley-style high growth and super returns (Query Insights and The Subtext, 2021). International investors have extremely high expectations for growth and return, are cautious to investment in Africa hence only provide funding when ventures are already having 1000s of users (Akiddie). Hence, for the time-being, EdTech ventures have to work and scale up only at the pace that their revenues allow for (Akiddie). For offline users a different pricing model is required as they can't be stopped from usage once they stop paying (PaperVideo). Also, since the offline solution is aimed at a poorer target group, the price range has to be significantly lower to achieve adoption (PaperVideo, Maarifasasa, Mtabe, Eneza, BrainShare, Worldreader).

Most online EdTech ventures in SSA opted for subscription-based revenue models for individual sales to parents (BrainShare, Gradely, Akiddie, Eneza, Mtabe, PaperVideo, Maarifasasa Clique NG). Many parents have no personal experience with subscriptions and don't know the benefits, so they are hesitant (Gradely). Consequently, one venture plans to introduce a freemium model for parents to better understand their offering (Gradely). One venture lets users choose between daily (0.03USD), weekly (0.15USD) and monthly (0.5USD) instalments which can make a significant difference in affordability for users (Eneza). One LMS venture benchmarks their subscription costs to the cost of attending public school in the country they are active in (Maarifasasa). While a large group of students can afford this pricing, it helps ventures at the same time to create a financially viable solution that can be scaled to reach even more students (Maarifasasa, Eneza).

For the on-demand tutoring, firms mostly charge a commission on the price per tutor hour (Classes.ng, Gradely). One venture sells licenses for its stories including granting other firms

to create merchandise from the stories figures (Akiddie). Some cover parts of their costs through subsidies. Others use their revenues from selling their LMS to corporates at a relative premium price (Maarifasasa). Similarly, ventures earn some extra revenue by providing specialized services to organizations (ASb, Kolibri).

Others also gets CSR sections of larger national corporates to cover their costs for individual learners by paying their subscription for a year through learning partnership (Eneza). Companies could also sponsor a subject related to their industry e.g., Mining company funding geography (Examsta). Another venture envisioned a model where well-known local brands cover their expenses so that children can learn for free (MLesson). In return, they would mention the brands in examples and stories in their content as research has shown that early childhood exposure to a brand creates a strong bond that brands can capitalize on once the children have grown up (MLesson).

3.6 FEASIBILITY PAN-AFRICAN EXPANSION FOR LEARNING AT SCALE

The purpose of this section is to better comprehend how EdTech ventures in SSA pick their next expansion destination. Most ventures seem to be active in the same countries, while others are left out of consideration entirely like Mozambique. The headquarters in the USA are the NGOs who work with African deployment partners.

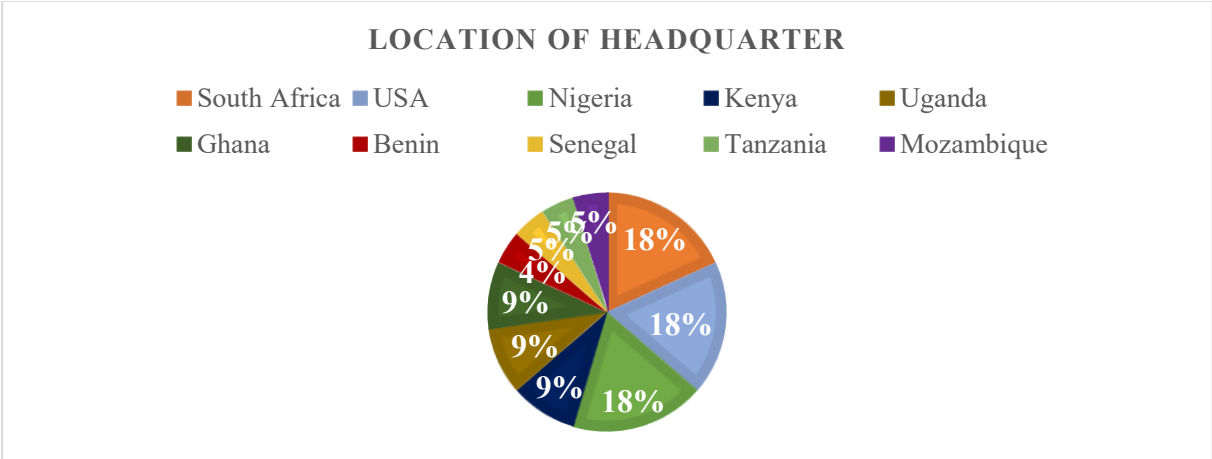


Figure 6: Overview location headquarter of benchmark ventures

All ventures aim to have local deployment partners who understand the culture and have a network there that saves a lot of time and resources (Eneza). Secondly, the market attractiveness also depends on the share of private education not only because of monetary funds (Gradely,

OwnLabs) but there is competition between private schools to use the most advanced tools and provide tutoring to achieve the highest average grades (Gradely). If one private school adopts an EdTech solution, they become sought-after products for the others in the country. Further criteria are the no. of students and their geographical spread across the country, the attitude of teachers and the ministry of education EdTech innovations as they can enable scale (Gradely, Zibuza) (scalability potential in *APPENDIX 4*). For blended or online ventures, the broadband penetration is important while SMS-based ventures look at the telecommunication providers active there. In every country, the regulations, setup costs and timeframe differ significantly hence a long-term vision for SMS-based ventures is required when making an expansion decision (Eneza).

Many consider the countries within the EAC and the Economic Community of West African States (ECOWAS) as similar markets making neighbouring countries there an easy expansion destination. Expansion is particularly important in SSA as many markets are small and don't allow for the required large userbase (Chalkboard, OwnLabs). Secondly, the official national language plays a major role as little content alteration will be needed despite a possibly large geographical distance like between Nigeria and South Africa (Examsta).

In terms of the tech ecosystem and EODB, there are considerable differences across SSA. Countries with a high digital literacy, an innovative mindset and most importantly good tech ecosystem, so first and foremost Nigeria, Kenya and South Africa, are considered very attractive (OwnLabs, Examsta). Other upcoming tech powerhouses are also popular like Ghana, Ivory Coast and Rwanda. While the EODB is very good in a few countries such as in Rwanda and in general in most named tech hubs⁸, SSA's rank would be significantly poorer, with some countries from the region closing the list⁹ due to challenges like corruption (Filipo, Mtabe). Digital cross-border operations for SMEs in SSA, particularly outside the tech hubs, have been extremely challenging, expensive and looked at with suspicion by governments (Ethale). However, the 2021 African Continental Free Trade Agreement (AfCFTA) treaty will make digital cross border collaboration much simpler and cheaper (Ethale). Only the NGOs (Worldreader, Kolibri, ASb) seem to be active on a pan-African scale including central,

⁸ EODB Index 2020 global ranks: Rwanda: 38/190, Tech Hub countries average: 92/190, SSA average: 150/190

⁹ The study looks at rules affecting business from inception through operation to wind-down: starting a business, dealing with construction permits, getting electricity, registering property, getting credit, protecting minority investors, paying taxes, trading across borders, enforcing contracts, and resolving insolvency.

southern Africa, the Sahel region and the Portuguese-speaking African countries (PALOP) while none of the other EdTech mentioned them as countries of interest for expansion. Despite the popular vision to reach the entire region, ventures only have an office in one to four countries.

The overall EdTech market in SSA is still at an early stage (atingi), so that even the most attractive EdTech markets are not satisfied yet. Therefore, EdTech ventures prefer those over challenging markets that rank poorly in all categories mentioned with hardly any existing tech ecosystem like Mozambique (OwnLabs). Having ventures from other parts of SSA deliver their successful solution there could contribute learning at scale in neglected areas (Filipo, atingi). It would be much faster than waiting for the national ecosystem to develop their own solutions as fundamentals are lacking (Ethale) (further information on timeframe in the *APPENDIX 4*). Therefore, expanding to these neglected markets would not only provide a competitive advantage but also enormous impact by reaching the underserved marginalised (MLesson, Clique).

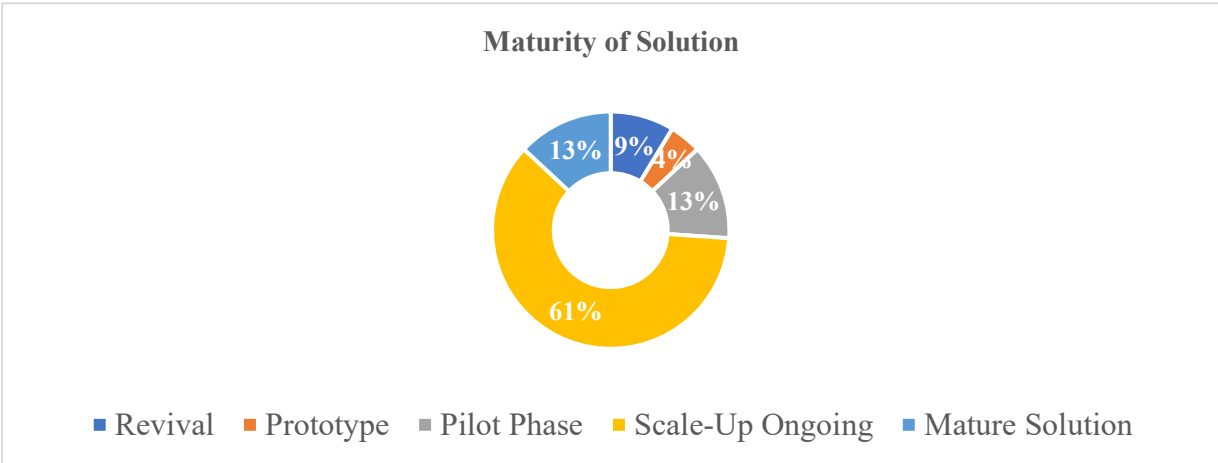


Figure 7: Overview Maturity stage of benchmark ventures

IV. IMPLEMENTATION SUGGESTION FOR EDTECH IN MOZAMBIQUE

4.1 INTRODUCTION GIRL MOVE ACADEMY

4.1.1 Description

GMA is a Portuguese non-profit association supporting the development of a new generation of female, socially motivated leaders to become agents of change through a transformative grassroots model. Ultimately, the aim is for them to impact the lives of everyone in their impoverished communities in the region of Nampula in Mozambique (more on Mozambique

in *APPENDIX 5*). For their youngest members called BELIEVE, 12 – 15 years old girls in the last year of primary school, there is a high risk of not transitioning to secondary school mainly due to unwanted pregnancies, entering early marriages and lack of cultural valuation for female education in their very conservative, mostly Muslim communities. At the heart of their strategy, GMA is aiming to empower and uplift them through an educational model with diverse activities to keep girls in school, as discussed in the *APPENDIX 7*.

4.1.2 Status quo GMA: technology and EdTech adoption

Pre-Covid there were no EdTech projects employed by GMA. The status quo of ICT is so poor and expensive in Nampula, integrating technology was initially not even considered (Rita). In a 2020 survey, GMA discovered that only 6% of all BELIEVE girls own a phone namely a feature phone. Hence, the digital literacy levels of the girls will likely be very poor. Also, GMA stated their mission is not to replace schools and they have a very relationship focused approach. At first thought, that doesn't combine well with EdTech. However, if rightly applied and integrated, EdTech could greatly contribute to their mission:

'In the (...) case of girls (...) education and connectivity should help form rounded and confident individuals who are fully aware of their potential, and who are empowered to live their lives with purpose, and to use their innate and acquired talents not only to their self-fulfilment, but also to the development of more prosperous, equitable and inclusive societies'

(Broadband Commission for Sustainable Development, ITU and UNESCO 2020a).

During COVID-19, GMA's attitude towards employing technology in the program changed and made them realize that 'through ICT they can bring GMA to the world' (Rita). Their changemaker lab with Vodacom during COVID-19, included providing the BELIEVE girls with a smartphone and a preinstalled educational app that taught basic literacy and numeracy, led by the older group of girls called CHANGE.

4.2 USE CASE GMA

4.2.1 Methodology

The databases researched for this thesis (mentioned in the methodology section), contained no EdTech ventures for primary and secondary education developed in Mozambique or even PALOP, only the digital publisher and bookshop Ethale. Therefore, one non-active Mozambican venture for tertiary education called Olenvo and one venture active in youth

empowerment and professional experiences namely GYPA were interviewed. Both interviews helped to understand the challenges, tech ventures in the educational sphere are facing in Mozambique. They starkly differed from the other ventures as the tech ecosystem in Mozambique is almost non-existent which leads to various further complications.

In the benchmark only one non-profit venture other than Ethale was active in Mozambique through a local deployment partner (ASb). None of the ventures interviewed knew of another Mozambican nor foreign venture active in the relevant field of EdTech in Mozambique. Therefore, the ventures from the benchmark were asked about their general scalability potential and interest in expanding to Mozambique. Except for two ventures, none of the others had even considered expanding to Mozambique. The only thing known about the Mozambican EdTech market was that the general infrastructure was supposedly poor. Aside from the ventures active in Mozambique and one with an upcoming pilot in Angola (Maarifasasa), none offered Portuguese content despite 30 million¹⁰ speakers in SSA.

The EdTech ventures from the benchmark were ranked in an Excel Spreadsheet according to how well they cope with the some of the challenges in Mozambique as well as their fit to the general challenges and needs mentioned by GMA. A score of 10 in a category meant the best rating (e.g., no internet required at all for the category internet) while 1 was the lowest possible score given (e.g. constant, internet connection with high data consumption required). Those insights were derived from expert interviews with Katia Almeida, director of the BELIEVE and LEAD program and Rita Megre, director of the CHANGE program as well as through correspondence and meetings with Sofia Barbeiro, GMA's fundraising strategist. Also, findings from the changemaker lab mobile study for EdTech usage by Vodacom were included.

4.3 GENERAL CHALLENGES WITH EDTECH ADOPTION FOR GMA

The three main challenges GMA is concerned about when introducing an EdTech solution will be analysed.

Regardless of the solution chosen, internet access will be unreliable even though there is WIFI at the GMA campus, but broadband coverage is very poor in the Nampula region. This makes

¹⁰ 6 countries with Portuguese as an official language: Angola, Cape Verde, Guinea-Bissau, Mozambique, São Tomé and Príncipe and Equatorial Guinea.

internet workarounds a non-negotiable criterion. Moreover, all content has to be created from scratch regardless of the venture chosen. This is because except for digital libraries, there are no solutions in Portuguese and no previous material available for the market. A great way to democratize education through technology would be to get it from the best private schools of the country as one ventures does it in Uganda (Maarifasasa).

4.3.1 Motivating study environment

Realistically, the vast majority of girls wouldn't study at home for multiple reasons: First, the lack of time, as most girls have to take care of chores after school. Second, it's a very male-dominant culture with the brother taking over the device at home being a likely scenario. Third, most people in Nampula are 'at the bottom of the Maslow pyramid: They're not living, they're surviving' hence education doesn't play an important role (Rita). This is partly because very few jobs in their communities require an education (Rita). In their local culture the concept of future is so unimportant that there isn't even a word for 'future' in their Nampula dialect. Consequently, decisions to make long-term investments are barely thought about, let alone being practiced. Therefore, the assumption, that once poor children in SSA finally have access to educational resources they will happily study on their own, no matter how dull the content or implementation is, is obviously wrong (atingi, Rita). Most humans need to be incentivized to do something. Therefore, fourth, incentives are key to prevent that girls will just stop using the solution after a couple of weeks (atingi). Rita reports that during their weekly community rounds with around 1000 girls, the attendance is approximately 50 %. Bringing a cookie for each participant and announcing to do so in advance, increases the attendance rate to 80 – 90 %, underscoring the importance of incentives in their society as well.

Some ventures employ gamified solutions such as IDEA with personal avatars and point scoring systems that lead to virtual awards. Rita stated it would be possible to pilot a gamified solution with reward point systems to figure out, whether it is sufficient as a motivation or whether more incentives are needed. It should be further looked into offline motivation mechanisms, like using internal score boards of achievements in the EdTech app or the number of e-books read with group competitions and prizes at the end of the term as many brick-and-mortar schools do.

4.3.2 Security

Robbery is the prime concern of GMA about equipping their girls with individual hardware, particularly for smartphones since very few people in the Nampula region can afford them. For their community visits, a device that would be suitable is the audio speaker by Chasing2Rabbits. It is a stark blue audio speaker hence recognizable. It can't be repurposed by thieves, as there is only teaching content on it. The speaker costs around 50 USD to serve an entire class, is recharged through its solar panels and is designed to be long-lasting. GMA could put any content on it including sex-education material or educative stories.

Overall, the GMA campus would be the best option as devices –shared or individual ones – could be stored and charged there. It does not only protect girls against their device being taken away from them, but they will have time and the academic group atmosphere, especially if encouraged through little competitions, that will serve as an incentive to study.

At the campus, a GMA e-library could be established with phones or e-readers stored there on which books from digital libraries or bookshops are loaded. Available EdTech solutions with books from Mozambican authors in Portuguese and even a few local stories and languages are the national e-bookshop Ethale and the online library ASb, provided by their Mozambican partner Little Zebra. Also, for the illiterate girls, devices with a Portuguese equivalent of RoboTutor could be accessible there.

While this could be implemented quickly, in the medium-term, an e-learning hub could be considered. It could possibly even offer better hardware like tablets or computers, similar to the way Maarifasasa provides access to quality education to the very marginalized without respective hardware in Uganda. In fact, Maarifasasa will have a Portuguese solution available soon as they are currently piloting in Angola. Additionally, the campus could become a location to experiment with Science through either VR goggles (Maarifasasa or OwnLabs) or with a physical set (TheScienceSet). All options would certainly be in line with GMA's mission of empowering and broadening the horizon of the girls with each visit.

4.3.3 Community Integration and becoming change maker

It was emphasized by GMA, that in order to empower the girls, their role in the community must change for instance by them contributing something that is valued by the community. Also, it is essential to keep in mind that a decision about the girls' life is made by the entire

family who decides on the girl's behalf for instance whether or not the girl may participate at GMA.

Akiddie seems to be a great fit as they combine appreciation for local culture with GMA values of female empowerment and implement it through technology overall contributing to preserving local culture and languages in the 21st century. Akiddie digitizes local tales in several languages including local ones as e-books making them widely accessible at low cost through an online library. This enables more children to hear stories from their own culture they can relate to. Rita mentioned a very rich culture in Nampula as well as GMA's passion for stories. Moreover, Akiddie actively creates their own stories for children in local settings as opposed to 'white princesses living in European castles waiting for a prince to rescue her' (Akiddie). Instead, Akiddie strives to illustrate empowered women who are financially literate, active in a profession or successful entrepreneurs, expanding the limit of dreams for girls to what they could achieve.

According to RoboTutor's field research as discussed above, this is the most powerful mechanism for educational success and strongly in line with GMA's values. Once the girls are literate and also sufficiently tech savvy, their community contribution could be to read those stories to younger children, write down more and create new ones in GMA's workshops. Those activities are all relationship-focused which matters to GMA while employing technology. In the long-term, their contribution would strongly help to preserve local languages and tales and be a change agent in a sustainable, culturally adapted manner (also stressed by GMA).

4.4 EDTECH NEEDS GMA

The three main needs expressed by GMA to accelerate the educational offering of their program in line with their mission.

4.4.1 Literacy learning and improvement

1. Literacy is a very essential life skill for anyone, particularly for future leaders. Half of the girls are illiterate due to extremely poor schooling. Literacy was picked by Rita and Katia as the most important skill among the subjects of benchmark EdTech solutions. Also, the GMA changemaker pilot with Vodacom tested out a basic literacy and numeracy EdTech app

underlining the own national awareness of the acuteness to tackle the high illiteracy. To serve the illiterate girls, a speech recognition solution with significant piloting experience like RoboTutor would be recommended as many ventures had to change numerous features until it was accessible and functioning in marginalized conditions. This is mostly due to the lack of data on realities of marginalized users and their extremely low digital literacy. Those solutions run on tablets that could be shared (for RoboTutor up to 10 students) and require ideally daily usage of around 40 minutes for optimal learning progress. Further research will be needed to look for a comparable solution in Portuguese as a translation for speech recognition is very challenging. Possibly some of the other Global XPrize finalists' solutions could work as they have all been successfully piloted in SSA or respective solutions from Brazil. Considering RoboTutor's finding that literate profession aspirations significantly increased literacy learning outcomes, GMA provides an ideal environment for literacy learning.

2. The other half of the girls, defined as literate, probably still has very basic literacy skills. A principal reason is the immense relative price of a physical book (Ethale). Most girls have probably never read a book as the first Mozambican e-book app which are much more affordable, was only launched in January 2021 by Ethale. Ethale offers a wide array of well-known and local literature while the ASb's partner offers children stories, which are not age appropriate but might be a good start for beginner readers. As suggested in the challenges, to broaden the girls' horizon and general knowledge in line with GMA's mission, a library with e-books from local ventures and e-learning solutions for literacy could be established at the campus.

4.4.2 Secondary school transition exam

Looking at GMA's target of the girls transitioning to secondary school from an academic perspective, passing the deciding end-of-primary school exam is indispensable. GMA's experience has shown, that if the girls fail, they will quit education entirely as many lack the confidence and have a different cultural perception of the importance of education. After literacy, GMA considered 'Specific exam preparation' solutions the most important. Due to COVID, GMA supported the girls for the first time in preparing for the mentioned exam, more in *APPENDIX 8*. Examsta specifically prepares students for final exams in a highly effective manner, focussing on its users confidently passing through strong content knowledge not preparing for outstanding grades. This would work well for GMA, as replacing schools is not

their focus, but in order for the girls to become socially oriented leaders, passing to the next level of education is a requirement their girls need to fulfil.

4.4.3 Horizon expansion

STEM education, in particular if studied at higher level, can have transformative powers on the development of communities. GMA is very much aware of that as they were at the time of the interviews in discussion with Fundação Gulbenkian to set up a STEM solution for teachers. However, it is worth for GMA to also consider some of the solutions from the benchmark which will trigger interest for STEM among the girls due to their innovative setup employing VR.

Possibly, this could lead to some girls continuing STEM at university. The 30 BELIEVE girls were selected from over 2000 applicants, with leadership and inspiration potential and cognitive abilities significantly above Mozambican average (Katia). Some girls are already independently experimenting in STEM, for instance during a cyclone in Beira in 2019, one advanced Girl Mover started to develop a beta version of an app for a drone for the emergency rescue teams to map where affected people were.

VR solutions for chemistry and biology with Maarifasasa's offering being the most progressed, allow as mentioned above to go beyond what's possible in reality and will broaden the girls' mind. A cheaper but also more ample option for experiments for physics would be the well-piloted one by TheScienceSet. Their concept of a 'Community Innovation Agent', which is a trained 'go-to-person' for questions in the community around the set, could be a great role for the girls. With respective funding local schools could be equipped with it and the girls will receive extra training and have access to videos on tablets at the GMA campus. Also, if the campus transforms into a learning hub with computers, a coding program like from outside-the-benchmark interviewed venture WeThinkCode might be relevant too. Coding skills are STEM and truly horizon expanding and the program of WeThinkCode is paid for by corporate sponsors and they strongly consider expanding to Mozambique. This might also change the previously discussed role in society for the girls, in particular, since STEM is around the globe still a strongly male-dominated field.

To conclude, something very important to keep in mind when choosing an EdTech solution is that despite their possibly low education level and poor digital literacy, the participating girls

are very gifted and thoroughly selected. They have a lot of potential as the drone example shows and a solution that inspires them and broadens their horizon like VR is very relevant. As Rita puts it ‘Don’t look at them from a perspective of scarcity but abundance’.

4.5 RECOMMENDATIONS AND FURTHER RESEARCH

Several solutions could be chosen as their content is not mutually exclusive. Therefore, differentiating between short- and medium-term implementation might be useful so that current GMA participants can already benefit from EdTech while the implementation of more time-intensive solutions could be planned. In the end, the cost of a solution and especially the available funding will also play a major role on the adoption decision of one or more solutions.

The solutions are best used at the campus which makes the hardware choice secondary, but internet workarounds must be in place. However, literacy learning should be implemented considering the importance of the skill and the fit with GMA. Without being literate, half of the girls won’t be able to use any of the other solutions either as all, but the audio speaker and STEM, require literacy. Further research is needed for a solution in Portuguese and possibly, the from Brazilian EdTech market. If an e-learning hub should be set up, further research into solutions for computers is recommended including coding. Help with very basic digital literacy - no matter which solution gets adapted - must be provided to keep the girls from dropping out. Providing the girls access and support to ICT will also contribute to their empowerment through digital literacy. Also, blended solutions – a mix of local languages and Portuguese should be further researched as well as additional classes to further advance the girls proficiency in Portuguese which often constitutes a struggle as shown by the Vodacom pilot. Furthermore, more research is needed on setting up a culturally appropriate incentive system for the girls to continuously employ those EdTech solutions. Overall, as suggested by Rita, piloting a solution first would be valuable, the implementation ease and costs are also ranked in the Appendix along other further categories, with Ethale and ASb scoring best.

4.6 LIMITATIONS AND FURTHER RESEARCH

The research conducted has several limitations, which provide recommendations for further research. First of all, the analysis is based on opinions and perceptions by professionals active in the EdTech in SSA, with their assessments of for instance costs or potential to scale being

very subjective. Here, further research is needed to validate the claims. Moreover, the status quo, trends and future plans were outlined which, particularly in the agile tech world and in a possibly fundamentally different post-COVID-19 world, can change rapidly. Furthermore, ventures were interviewed under the potential prospect of a collaboration with a European NGO and the prospect of their statements being published in this thesis. This might have influenced the description of their ventures to a more positive outlook as well as their uttered level of interest in Mozambique. Lastly, SSA is a very diverse and large region, difficult to compare. Further research will be needed into specific regions and respective localization.

This thesis should be considered as a first step by providing an initial overview of the status quo of EdTech solutions in SSA, in order for GMA to further look into ventures with relevant characteristics and into concrete implementation suggestions for instance by the World Bank EdTech Report 2020.

V. CONCLUSION

The benchmark analysis has shown that there are various promising EdTech solutions in SSA to enhance learning outcomes and broaden students' horizon, with several enriching business models for GMA. Now, the challenge for EdTech is to achieve mass adoption outside the few tech hubs and reach the impoverished 'hard-to-reach' children.

The findings of this thesis provide empirical insight into which features of EdTech solutions contribute to achieve quality education at scale - including for marginalized learners. There are many other factors than just broadband and hardware access for an EdTech adoption – nevertheless, they could become the bottleneck if not incorporated for. Most ventures have great internet workarounds in place with the zero-rated status increasingly being offered to EdTech applications. Concerning hardware, the tech world mostly builds for the near future integrating personalisation features for when smartphone adoption and digital literacy will outweigh feature phones and tech resistance.

The benchmark analysis showed that the EdTech product range mainly focuses on the same age groups, subjects and few official languages. More variety is needed for students to discover and pursue their passions while the integration of major African languages is essential, at least in a blended model, so that shortfalls of public education won't be repeated. Concerning the

distribution, numerous complications caused by selling to schools have been analysed but for the time-being, most ventures consider schools the best option to reach scale, especially in marginalized regions. For sustainable school adoption, ventures significantly invested into digital onboarding of teachers, who pass on their knowledge, guide and incentivise students. Individual adoption by truly marginalized groups in particular in the LDCs rarely happens as most ventures don't sell there because it's not feasible. Significant investments to overcome various socio-economic barriers would be needed in return for a very small profit margin per user. According to atingi, the marginalized can't be targeted first but 'will be the last to be reached through a spiral, friends-to-friends approach'.

Overall, the EdTech market still is at an early, national rather than pan-African stage. This is mainly due to the severe lack of funding despite great existing products with strong impact potential for learning outcomes, essential life skills and broadened outlook on life. Most ventures have pan-African ambitions, strongly prioritising countries with anglophone and francophone speaking developed tech ecosystems rather than lusophone ones. For successful implementation, solutions will have to be adapted to the local culture and setting, creating multiple products from the same one coming from a regional perspective (Filipo). The vast differences in the EdTech market, tech ecosystem and digital literacy across SSA need to be incorporated and sufficiently piloted.

Employing an EdTech solution works very well for GMA considering that their empowering approach leads to higher learning outcomes while girls will be empowerment through knowledge, new digital skills, strengthening their mission further. Several benchmark applications won't just teach the girls valuable knowledge but help them grow towards becoming a change agent. GMA could pave the way for quality learning at scale through EdTech in Mozambique to break the cycle of poverty.

Although there are some limitations to this work, the findings provide an overview of the EdTech landscape, contribute to existing literature and the ongoing discussion about 'learning at scale through EdTech' for the region of SSA by providing empirical evidence.

VI. LIST OF APPENDICES

APPENDIX 1: TECHNICAL IMPLEMENTATION: APPS

Not all mobile ventures actually have native apps, or they are not publicly available. Numerous stress that they are currently working on building an app or just released theirs like TheScienceSet, Akiddie or atingi. The development is much more expensive and complex than for a web-based app as mentioned by Examsta and often challenging in terms of finding local sufficiently skilled developers or when hiring them from abroad due to a lack thereof dealing with unclear jurisdictions concerning the import of IT (Ethale). In countries with a poorly developed tech ecosystem, such as Mozambique, developing an app can take several years (Ethale). Many ventures have decided against it for the time-being such as Bookconekt, Examsta and Maarifasasa who explicitly stressed though that their websites are designed to be extremely mobile responsive. When talking about the scale potential of mobiles, the dialogue refers to feature phones which, however, don't have the depth of content nor the technical means to employ pedagogically superb and entertaining solution designs. As emphasized by Prof. Jack Mostow from RoboTutor, basic features phones are not ideal for more complex solutions that require a lot of interaction, data collection, storage or even a keyboard such as for coding. Furthermore, a very small and basic screen can negatively impact the learning experience and outcome if it's too small to properly see the content as mentioned by IDEA. Also, there is a higher risk of phones being stolen as they can easily be repurposed and due to their high adoption, it wouldn't be evident that a person is using a stolen device as the same phones are widely available at affordable pricing even for marginalized communities.

APPENDIX 2: TECHNOLOGY: INTERNET WORKAROUNDS

With pure offline solutions, no updates are possible, so the solution needs to be **error-free and of high quality** from the start (Kolibri). Therefore, most solutions are blended allowing for wide reach and rich content as it can be downloaded. Internet access is required for the initial download, periodic updates and to synchronize some data (Worldreader). A **drawback** is the **lack of reliable data which** inhibits personalized learning, improving the solution based on pain points and only provides unreliable impact measures which are highly relevant for funding. Moreover, offline solutions stand in **stark contrast to the agile tech world** with a very quick cycle to development.

Being zero-rated prevents the cost pain point important for B2C, which some gained through **competitions** by the telecommunication companies such as the MTN APP Award (Examsta)

while others were awarded it through **collaborations** with the Vodafone foundation (Kolibri). While ventures from outside the region's major tech hubs (Olenvo and Bookconekt) never heard of a zero-rated status in the context of EdTech, others are **striving to get recognized (Mtabe)**. One venture stated that there are certain technical requirements which prevented them from getting zero-rated (PaperVideo). Other existing blended workarounds include **BRCK** and peer2peer **internet sharing between several computers** (atingi). Another way is for learners to transport their own data on an **USB stick** until they reach a computer connected to the internet where they can insert and upload it (atingi, TheScienceSet).

Entirely offline learning supports scalability as **marginalized learners** often have **neither smartphone, can't afford sufficient mobile data** and live in areas with very poor broadband access (MLesson). One way is via SMS (Eneza, Mtabe, MLesson). Another completely internet free concept provides content on **micro-SD cards** which users can simply insert into their feature phone (PaperVideo). A book with practise questions is delivered and next to each question is a QR code, which leads, as mentioned, to a respective explanatory video, stored internet-free on the micro-SD card. Another workaround for ventures with additional hardware is for solutions designers to simply download the program onto hardware and then handing it out to students in the form of a MP3 speaker (Chasing2Rabbits), a VR goggle (OwnLabs) or a tablet (RoboTutor).

APPENDIX 3: DISTRIBUTION: MARKETING

Several ventures such as Gradely, TheScienceSet and Classes NG name B2C-Marketing having the parents getting to know about your EdTech venture as one of the most challenging aspects of distribution while keeping the costs low as a start-up, hence guerilla tactics for low-cost Marketing at scale are common with Gradely.

B2C Parents

For the individual adoption, the prime source of Marketing is Social Media with Facebook being mentioned by some as the most important but also Twitter, Instagram, tiktok, Whatsapp and Linkedin (Examsta, PaperVideo, WeThinkCode, African story book initiative, Olenvo, Gradely, MLesson, Mtabe, BrainShare, Akiddie). However, as many ventures specifically target the off-grid users without reliable internet access, other Marketing measures such as the community radio, a very cheap but targeted at the rural communities as done by Ethale and reaching scale or TV also work. Eneza mentioned that in Kenya, to reach the masses of people

in rural areas, advertising on the local radio stations which are not in the national languages English or Kiswahili but the local ones, works incredibly well for their target group. Because of at least a very unstable and unreliable internet access of their target users, Mtabe considers school visits the most important way to market despite them also being present on social media. Also, in terms of direct Marketing, many advertise their solution at universities (Olenvo) or at schools (MLesson) e.g. Through posters and flyers like Bookconekt, who then gets contacted via Whatsapp by the parents for further information. Also, Examsta, hired a Marketing agency which successfully generated many new leads through exposure in neighbourhood magazines and web forums where parents give advice to each other. Gradely for now is mostly relying on Guerrilla techniques until they will get major funding to allow for targeted ads. For instance, Gradely has their own influencers on their team, who are being very vocal about how much they like Gradely in various Facebook groups with the purpose of homeschooling, teacher communities etc.

APPENDIX 4: SCALABILITY: SCALABILITY POTENTIAL

The EdTech sector remains one of the last sectors to be transformed by technology, with less than 4% globally of the education sector spend on technology in 2021 (Shiohira, Keevy and Gibbs, 2018; HolonIQ, 2021). The poorer the public education system the higher the WTP for private education if the economic situation of parents allows (Nishimura and Yamano, 2013). In rural Kenya, enrolment rates in private primary schools have more than doubled over 3 years¹¹, with poor schooling as the main reason (Nishimura and Yamano, 2013). This provides great potential for EdTech – through individual users and competition between private schools triggering interest in innovative learning concepts (Thapa, 2013).

How would an expansion look like?

Most ventures started by executing pilots in several schools for at least several months as mentioned earlier with a lean entrepreneurship approach. Once they proved their business model, they started to expand (selection criteria discussed above). For the ventures offering an online LMS platform, they consider the fact that they can essentially expand to any country immediately without making changes to their technology or having a physical base there as their strongest point of scalability, mentioning that it doesn't cost them much to add and manage

¹¹ From 4.6% in 2004 to 11.5% in 2007

another user or school on the B2B-level (BrainShare, Chalkboard Education, Gradely, Akiddie, Maarifasasa). Akiddie mentioned that one person on the ground in a new country would be more or less sufficient just to work out the finer details. Or as Maarifasasa mentioned, even work remotely as COVID has taught us in particular with their operations being mostly online. However, in the initial stage, he believes it is essential to have some physical meetings as Africa is only slowly adjusting to digital and in particular in the education sector, meeting the decision makers in person is considered very important before the operations can eventually be adopted to be exclusively online.

In the case of Chasing2Rabbits, they rather pursued an academic approach to entrepreneurship and stated that they are currently not looking to expand to any further villages within the Baka community. Their criteria for selecting a new location would be the following: demand also in the sense of enough school-aged children in the village, enough potential teachers in the village who are literate, the content approval of the ministry of education and being at most a day motorbike journey away from their headquarters as their business model requires at least a partnering organisation to be constantly present on the ground to support the aspiring teachers, it wouldn't be as quick as the purely tech solutions. As there is a lot of demand, expanding also to a different community and context with their concept is something they would certainly do with the right partner as a cultural and contextual fit is essential for the success of their very culturally sensitive venture.

Timeframe expansion

In terms of the timeframe, expanding to a new African country, ventures with an entirely online offering, cloud-based solution said they can do it basically immediately with a couple of days being the longest timeframe named providing support remotely, provided however, that the customer has the content ready for the onboarding on their platform (Chalkboard, Maarifasasa, Clique NG). Bookconekt believed it would take 2-3 months with a local partner while Worldreader or Mtabe said it would take them approximately 6 months of creating the documents for the curriculum provided that they have partnerships in the new country. Especially, if the official language is the same and the curriculum fairly similar (as pointed out by Examsta). For an SMS-based solution (Eneza), the question-and-answer part took 2-3 months to kickstart as it doesn't need to be developed, preparing the materials while they are already operating takes a bit longer. All of it is influenced by the cooperation with the telecom operators chosen as a partner in the respective country which can speed up or slow down operations significantly. If the content for an entire curriculum does have to be created digitally,

it takes approximately 6 months according to Worldreader and involves collaboration with local content developers, optimizing it and creating tasks with it, being approved by the Ministry of education, as well as creating a mobile version. While solutions which require a physical space such as WeThinkCode stated 1 year as a timeframe to find funding, setting up the space and recruiting IT teachers and advertising it to prospective students. For some ventures who significantly need to invest in content and software development (such as VR-based solution OwnLabs), they would only expand to a new country due to a pre-defined viable order size of a client there. Only with a reliable partner there and the prospect of significant adoption, expansion would be worth it for PaperVideo to create the content for another curriculum in a new language. Other criteria that would speed up expansion would be if they could create the content in the country themselves thanks to a developed VR ecosystem with local developers who also then know the culture, language and curriculum rather than creating it externally and hiring extra staff for those tasks.

APPENDIX 5: INTRODUCTION MOZAMBIQUE: INTERNET

In 2017 only 21% of the Mozambican population was occasionally using the internet, scoring even below the SSA average at 24.4% (GSMA, 2020). The poor internet usage is due to low salaries and very high relative costs for data at 10% GNI per 1GB per month (ITU and Alliance for Affordable Internet, 2021). The poorest 40% of the Mozambican population would have to invest 27- 48% of their monthly salary for 1GB of data in 2016 (ITU and Alliance for Affordable Internet, 2021). The Alliance for Affordable Internet compared Mozambique's affordability to the SSA average in five categories namely: Regulatory Environment, Broadband Strategy, Universal and Public Access, Infrastructure Sharing and Spectrum Management. On a scale from 1-10 with 10 being the best, Mozambique scored between 4.6 and 6 - mostly below the SSA average. However, new policies have come into effect that could possibly trigger a downward shift in costs.

APPENDIX 6: GMA: DESCRIPTION

The program is sub-divided into three categories namely Believe, Lead and Change which are connected resulting in a Cascading Mentorship Model. The participants of the Believe program are girls aged 12-15, at the transition stage to secondary school from grade 7 to 8. The public education system is so poor, that even after 7 years of school, GMA's study showed that almost half (48%) of their above average bright, selected members, were illiterate. As secondary school is not compulsory in Mozambique, at this age, girls run the highest risk of dropping out of

school due to family pressure and cultural norms to support with chores but mostly due to unplanned pregnancies as they become sexually active at this age. The female dropout rates in Nampula province are the second highest in the country. Sociocultural norms make girls perceive their roles only as becoming mothers and wives, education of women is not valued by many. GMA selects the girls as members with the seemingly strongest personalities that are most likely to impact their communities. The main goal is to empower the girls psychologically to continue with their education and start to believe in themselves and their abilities, thereby developing their true potential to improve the situation in their communities. While the former is achieved through additional tuition, sport activities the latter is worked on by the second group of participants: the lead girls. They are university students selected for their potential who keep encouraging the girls by working as a mentor to 30 students and meeting them on a weekly basis. That program in leadership and social innovation is the first of its kind for female university students in Mozambique. The third group named Change, consists of a network of women with tertiary education, striving to build/ strengthen careers with impact organizations as disruptive leaders improving the lives of their communities, with an over 80% employability ration of program participants. Overall, women as agents of change will raise the economic, political, social and human development level in Mozambique.

Currently, GMA is pursuing the proven ‘Safe Spaces’ methodology for their BELIEVE girls, by selecting a location in the community for recreation, activities and training led by the LEAD girls as mentors. The goal is to support them in learning skills such as resilience, teamwork and leadership also through sports such as Rugby. A key aspect of the program is the changemaker lab, which constitutes a collaboration between companies and the Girl Movers from the CHANGE program who are contributing to a product design process for the corporate. Thereby GMA receives some funding from the private sector, helping them to create valuable culturally adapted products for impoverished regions but also it allows the girls to gain new experiences in a professional environment with the ultimate goal of them joining the formal sector. This year’s changemaker lab theme is Technology (Tech 4 GOOD) and for the first time, one of the main topics of Changemaker LAB.

Achievements

The so-called triple layer mentorship relationship allows mentors to create impact and to fight the cycle of poverty while mentees get encouraged to reach their potential and believe in a better future through the experience of female role models who lift them up. This model is considered a differentiator element creating systematic global change by ASHOKA. For the BELIEVE

program, their impact in seven years since their foundation in 2013 achieved the following impact benchmarks: 4720 participants of whom 88% transitioned continued schooling and less than 2% becoming pregnant.

Eventually they strive to reach further African countries with their impact model, supporting the rise of a novel generation of impact-driven African Leaders with women as agents of change to transform the world. GMA describes its mission as follows: ‘lead an educational and mentorship movement which multiplies opportunities for young women who want to change the world’. The focus of this feasibility assessment will be on the Believe girls, since they are at the stage of their educational path most at risk. Their educational need is the greatest. While the Change and Lead girls are familiar with technology, frequently using Facebook even for contact during the pandemic with GM and almost all change girls owning phones, many even smartphones, the digital literacy of Believe girls is almost non-existent. Only 6% ‘have access’ to a phone, more precisely a feature phone.

APPENDIX 7: GMA DESCRIPTION: EXAM PREPARATION GMA

It has been their main priority to support the BELIEVE girls in preparing for those exams as they were taking place in January 2021 even though schools were closed entirely from March until November 2020 due to Covid with 2 weeks holidays shutdowns in December due to Christmas. While during the school closures, the official national policy implied schools regularly handing out worksheets to continue education, in reality all ten partner schools of GMA lacked the money and methods to print those hence there was no access to learning whatsoever. The Lead girl mentors are helping with the exam preparation this year as there is close to no help from the teachers. The mentioned exam tests four subjects namely: natural sciences, human sciences, math and Portuguese.

APPENDIX 8: CATEOGRY MATCHING GMA: B2B VIA SCHOOLS and B2C

All in all, when it comes to personal hardware requirements, the average score was 5,05 as many do require it or expensive ones, at risk of robbery. While nowadays in the vast majority of the globe technology is the mean to reach the masses, this isn’t the case for most parts of Mozambique just yet. The few ventures that don’t require smartphones are those, that also as a consequence, work well for the communities and aren’t designed for personal usage hence have to be stored e.g. At a school or campus namely the VR goggles of OwnLabs and Maarifasasa, the audio speaker of chasingchasing2rabbits, RoboTutor’s tablets and TheScienceSet’s set. Basic feature phones scored 5. Women are nowadays autonomous with their feature phones

according to the Vodacom pilot conducted in Nampula, which is a new development. Aside from the robbery fear, the pilot conducted by Vodacom with women from rural Nampula has shown that only very few own a smartphone as they don't value smartphones. Due to the fact that they are not aware of most functionalities and advantages, they just consider them as too big to carry comfortably, requiring a lot of energy, having a short battery life and being easy to damage all opposed to the much cheaper feature phone. Rita calls it a systematic issue and emphasized that individual study conditions at home are truly not given as many don't have running water at home let alone electricity to recharge the phones. Though those are the aspects they truly value hence unaware of the advantages, the enormous potential of smartphones e.g. For education is not truly exploited. Aside from taking the mentioned features valued by women from rural Nampula into account, GMA's recommendation for smartphones include a battery chargeable with solar energy and name the average WTP at 2500 MZN (EUR 27.36), ideally in monthly instalments at MZN 150 (EUR 1.64). According to the study, if the women had savings, their current average WTP is at MZN300 which equals roughly 43,40€ which is also below the cheap smartphone Transsion brands in Africa which start at USD 50. Moreover, smartphones require the extra expense of airtime recharges which even the female smartphones owners in the Nampula community barely do. When it comes to the cost of recharges, the majority doesn't control it and would highly appreciate support in controlling the bills. An end-of-the-month report was suggested by GM. There is fear among the communities about smartphone usage and internet-related risks firstly, because it is considered 'a virtual reality' – which also doesn't speak in favour of VR for STEM, but also because of the fact that users have to have money on their phone, threatening their sense of security. Lastly, there is a particularly high illiteracy among women in rural Nampula that makes smartphone usage for them close to impossible. Consequently, intensive awareness work is needed for women to be interested in smartphone usage. They are best reached, according to the Vodacom report, through radio, TV, SMS and promotional calls, on the street and 'word of mouth'. Also, besides from all of this, providing all Girl Movers with smartphones would require significant monetary funding which GMA at the moment doesn't have but could potentially raise. Nevertheless, they should further look into hardware grant programs given out by e.g. Worldreader. Consequently, e feature phones seem to be a more attractive option. Although it is important to keep remembering that their services to portray education content are much poorer. During the first COVID-related lockdown, GMA sent text messages to check upon the girls, which had to be very simple and short, even without emojis in order to arrive at the recipients due to the old, basic phones many people were using. Also, as mentioned, only 6% of the girls owned a phone themselves. During

the lockdown, the staff members called family members and had to often be passed on to several people before reaching the GM they wanted to talk to. Often, the girls were then not comfortable talking in front of their relatives or there were technical issues with the phone. Despite all those challenges, it is essential to remember that those aren't caused by the children and that on the contrary, most children are very keen and open to get to know and adopt new technologies. Rita even goes as far as saying that she could imagine it would motivate them thanks to the variety and new means to study. But concerning individual usage at home, there will be struggles with electricity for the girls to charge their devices as well as the need for most solutions of internet access for the initial download and occasional updates. All in all, the individual usage at home solutions can be pretty much ruled out for GMA.

When it comes to B2B solutions via schools, due to the systematic nature of the problems in schools in Nampula, introducing a modern LMS software or an e-learning hub for instance in collaboration with the teachers would pose a tremendous challenge according to Rita. She and Katia believe it would take decades as schools are even lacking the fundamental infrastructure such as running water, functioning toilets and electricity. While a comprehensive EdTech solution would enormously contribute to improving the quality of education and teaching (pedagogically and academically) everything would need to be addressed: the infrastructural conditions, the culture, the traditions, the authority structure in regard to females, the level of interest in education by local politicians and GMA's decision makers, bureaucracy and other struggles when dealing with the Ministry of education.

In terms of the academic status quo, part of it is the lack of required digital literacy for such a solution even among teachers many of whom on top of that, also lack relevant knowledge content-wise about their own subjects they are teaching. The digital illiteracy is likely to be paired with a tech resistance. The first challenge as stated, is to get the teachers to properly adopt it, next the children will follow but without the teachers, only as PaperVideo calls it the few 'self-starter' children will adopt it, not the masses even if provided access to it via B2B2C. Some ventures provide guidance when it comes to digital literacy with an average score of 6,95 though some also scored well if there was no particular guidance but due to the very low amount of knowledge required it wasn't necessary such as SMS-based solutions working on feature phones. The top ventures include Chalkboard Education who offers an onboarding tutorial designed for low tech-literacy users. In their B2B collaboration with schools in rural, marginalized areas, PaperVideo supports the school in implementing their solution in person. This is particularly relevant during the first few weeks because according to PaperVideo and

Idea, without guidance during that time, teachers will just stop using the program as they don't realize the benefit of it for their lessons, their students' learning progress and the massive increase in efficiency when it comes to their own workload. They described the tasks of sales rather as one of supporting the usage and providing guidance during the implementation overcoming prominent tech-resistance among teachers. Usually, Idea selects a 'teacher champion' who is very knowledgeable about using their program and who the others can come to for questions. Moreover, RoboTutor built extensive workarounds to overcome initial login struggles of their low-tech, illiterate child users. Instead of typing in their credentials, a voice provides instructions, there are arrows and symbols on the screen, and they work with pictures of the different users of one shared tablet, which the users have to select in order to log in. The struggle that initially all children registered again and again because they loved to take selfies required for the registration, was overcome by creating a selfie option rather than registration at the stage of the login. Lastly, there are no digital literacy struggles with TheScienceSet as it is physical and the videos explaining the experiments are basic knowledge to be played. A low digital literacy must be assumed among the Girl Movers accordingly the mentioned ventures all seem very suitable in that regard.

APPENDIX 9: CATEGORY MATCHING: INTEREST IN MOZAMBIQUE

When questioned about their willingness to expand to Mozambique and their existing knowledge about the Mozambican EdTech market, the results were very poorly, with an overall potential interest score of expanding there ranging at 4,55. This score is still just potential and already includes many biases (potential NGO funding) that possibly lift it up. Apart from the Mozambican venture Ethale and ASB, one of the few ventures that seemed generally interested and informed was Kolibri. Previously they conducted a pilot there and stated they were currently looking into expanding to Mozambique. Also, they have some Portuguese content and Portuguese speakers on their team thanks to their activities in Brazil. Then there is Chasing2Rabbits whose conditions depend much less on what language and culture is dominant but on a match in regard to mission and values with the deployment partner which could suit GMA well as discussed above. Next, would be the majority of ventures who didn't rule it out and wanted to expand to Mozambique eventually as part of their reaching all of SSA strategy. If provided the funding for the expansion, those ventures stated they would be very interested in expanding there but if they finance their own expansion, the lusophone countries will come at best 3rd if not 4th priority after not only English and French-speaking but also Arabic-speaking countries in the North. This includes the speech recognition software of RoboTutor, stating they

would first pick francophone states. Maarifasasa argued exactly like that but currently they are piloting in Angola thanks to funding received from there, which could move Mozambique a bit up their list as they will have Portuguese content available. Others, like Mtabe or Worldreader already had their expansion plans set and confidently rules Mozambique out for the next 3 or even 5 years.

APPENDIX 10: CATEGORY MATCHING: EASE OF PILOT IMPLEMENTATION

Since Rita mentioned that if not too costly and complicated, GMA would be very open to pilot a promising solution, the interviewed ones were ranked accordingly with an average score of 6,8. She considered testing it with girls who live close to the campus and other girls living in communities in urban areas as the latter have a better digital literacy, so understanding the differences will be great learnings for further implementations. For the pilot, the prime barrier is language and in terms of the complexity of changing the language to Portuguese and possibly local languages, the average score was 6,8 with 10 meaning it is already in Portuguese, which only applied to ASB, Ethale and Kolibri scored a nine with some Portuguese content for Brazil. Due to their pilot in Angola, Maarifasasa should by now also have Portuguese content available. In general, the online book shops and e-libraries and the LMS platforms without content scored the highest, as the books probably already exist in Portuguese and just need to be acquired while a platform basically with a DIY approach to content creation also is fairly easy to be translated. Next, the STEM solutions could probably also fairly easily be translated as there isn't much content to it with mostly experiments. However, the purchase of the VR goggles, often also only made in bulks of at least 30 for OwnLabs, would be very pricey while it's affordable for TheScienceSet. Moreover, a pilot with a SMS-based learning venture should also be relatively easy and not very costly however, those require a partnership with a telecom operator at the likes of Vodacom and according to Eneza, a market entry only pays off if at least medium-term involvement in the country can be envisioned with an approximate timeframe for the expansion of around 3-4 months. Content-rich solutions with many animated features and videos also face a more strenuous translation process like Gradely or Idea. At the other end of the score system is RoboTutor for instance with its speech recognition approach to teach literacy which is so far only in English and requires an enormous amount of effort to get translated. Something to keep in mind though, is that among the 4 major factors preventing large scale app usage on smartphones by women in the Nampula region in the Vodacom pilot, poor knowledge of Portuguese was named a major barrier. The recommended course of action by the locals was to employ the local language instead of Portuguese. While translating might be a lot of work, it

will surely be much faster than waiting for more local solutions to develop which will take many years due to the almost non-existing start-up scene and the many factors previously discussed preventing it from thriving. Rita stated that in Nampula hardly anyone had the capacity to film for their GMA video clips, only in Maputo there were a few people able to do so. This illustrates how far the region is from developing a sophisticated EdTech app. In terms of COVID-friendliness, the ventures with a B2C approach hence individual device ranked best, such as SMS-based, PaperVideo with their book and SD card or TheScienceSet with the individual set with an average of 4,5 as the ventures with shared devices for the campus got a 1.

APPENDIX 11: CATEGORY MATCHING: FINANCIALS

Comparing the affordability of the interviewed ventures, the average score amounts to 6,3. Due to GMA's limited funding as mentioned, the more affordable a solution is the better. One major barrier to large-scale adoption in the Vodacom plot was the low buying power of the consumers, therefore, to reach high user statistics, free applications were recommended and the required hardware to be purchased by GMA is taken into account for this category. The same applies to the data charges as the recommendation from Vodacom pilot was also to zero-rate the app. The required personal funding for a hardware purchase is something many Mozambicans lack due to a poor general purchasing power. While no venture scored 10, the SMS-based ventures received a 9, as their solutions cost around 0,5USD per month on a subscription-based model plus the cost of a feature phone is around 10USD. TheScienceSet costs 15USD with no hidden cost, also scoring fairly highly. While Examsta and Kolibri are even free, and don't require internet or at least no data costs in the case of Examsta thanks to being zero-rated, but smartphones or tablets are required for usage. Very expensive ventures on the other side of the list would be the VR ones or the set-up of an e-learning hub for LMS usage.

APPENDIX 12: CATEGORY MATCHING: EXPERIENCE OF THE VENTURE

Comparing the experience and stage of the venture e.g. In terms of years active, countries expanded to, EdTech awards received and positively taking into account whether it is an African solution, the overall score is 7,2. Best scored the South African venture 'The African Storybook Initiative', active since 2013 in 14 countries in SSA, including 221 languages and 1859 with 6601 translations. Eneza as a Kenyan solution active for over 10 years also received the top score, currently active in 4 African countries also in Western Africa, including a

language switch to French.¹² While Kolibri and Worldreader are also very experienced ventures active on several continents in multiple countries, they are both not an African solution, losing a point for that. TheScienceSet on the other hand has Ghanaian founders, is selling to 40+ countries and supported by large-scale players such as Make-IT in Africa by GIZ and won many awards. Currently, they strive to physically expand to other countries in SSA by setting up factories there. Overall due to the selection process, many ventures have won prestigious international awards in the field, have founders who have been active in the space for many years. However, it seems that most ventures are rather at an early stage, as is the EdTech market in SSA, as despite the uttered aim to become a truly pan-African company, the majority still mainly operates in their home country.

APPENDIX 13: CATEGORY MATCHING: GMA NEEDS AND CHALLENGES

Business Name	Subject importance ranking	Subject importance ranking: 10 = most important
Maarifasasa	8	STEM: (3/5)Rita important from secondary level onwards and 4/5Katia already in discussions Gulbenkian that's why, tutoring marketplace: not really discussed only specific exam prep, curriculum aligned: (importance to improve school gigantic not their mission / systematic change Katia 5/5, Rita4/5)
OwnLabs	8	STEM: (3/5) Rita important from secondary level onwards and 4/5Katia already in discussions Gulbenkian for STEM implementation
Examsta	10	both said very important, biggest immediate life-effect totally in line with mission to continue school, important for all (literacy only for 48% illiterate children)
Kolibri by Learning Equality	5	basic additional curriculum aligned: (importance to improve school gigantic not their mission / systematic change Katia 5/5, Rita4/5)
Mtabe	3	basic additional curriculum aligned: (importance to improve school gigantic not their mission / systematic change Katia 5/5, Rita4/5)
Eneza Education	3	basic additional curriculum aligned: (importance to improve school gigantic not their mission / systematic change Katia 5/5, Rita4/5)
Akiddie	9	Literacy (very important for children who can't read plus 'readers' need to improve their skills BUT solution only relevant for basic readers hence 52% of GMA's Maruwis, Rita 10 Katia: 1-2/5) minus not literacy teaching solution
Chalkboard Education	5	no content: free to set up anything SaaS
gradely.ng	2	curriculum aligned: (importance to improve school gigantic not their mission / systematic change Katia 5/5, Rita4/5)
Bookconekt	9	Literacy (very important for children who can't read plus 'readers' need to improve their skills BUT solution only relevant for basic readers hence 52% of GMA's Maruwis, Rita 10 Katia: 1-2/5) minus not literacy teaching solution
Ethale Books	9	Literacy (very important for children who can't read plus 'readers' need to improve their skills BUT solution only relevant for basic readers hence 52% of GMA's Maruwis, Rita 10 Katia: 1-2/5) minus not literacy teaching solution
2 Rabbits	2	curriculum aligned: (importance to improve school gigantic not their mission / systematic change Katia 5/5, Rita4/5)
Classes.ng	3	Tutoring platform for exams outside curriculum including language tests and entry tests for foreign universities (horizon expanding) but only relevant at the end of secondary school
African Storybook	9	Literacy (very important for children who can't read plus 'readers' need to improve their skills BUT solution only relevant for basic readers hence 52% of GMA's Maruwis, Rita 10 Katia: 1-2/5) minus not literacy teaching solution
BrainShare	2	curriculum aligned: (importance to improve school gigantic not their mission / systematic change Katia 5/5, Rita4/5)
Worldreader	9	Literacy (very important for children who can't read plus 'readers' need to improve their skills BUT solution only relevant for basic readers hence 52% of GMA's Maruwis, Rita 10 Katia: 1-2/5) minus not literacy teaching solution
RoboTutor	10	Literacy (very important for children who can't read plus 'readers' need to improve their skills BUT solution only relevant for non-readers hence 48% of GMA's Maruwis but possibly others reading skills are also far from perfect, Rita 10 Katia: 1-2/5)

¹² Moreover, they were recognized as best on **map by Briter Bridges** top funded category e-learning and tutoring.

PaperVideo	2	curriculum aligned: (importance to improve school gigantic not their mission / systematic change Katia 5/5, Rita4/5)
Clique	2	curriculum aligned: (importance to improve school gigantic not their mission / systematic change Katia 5/5, Rita4/5)
IDEA	2	curriculum aligned: (importance to improve school gigantic not their mission / systematic change Katia 5/5, Rita4/5)
The Science Set	8	STEM: (3/5Rita important from secondary level onwards and 4/5Katia already in discussions Gulbenkian thats why),
M-Lesson	3	basic additional curriculum aligned: (importance to improve school gigantic not their mission / systematic change Katia 5/5, Rita4/5)
SUM	123	MEAN: 6,15

Business Name	Mission alignment	Mission alignment: 10 = very relationship focused model, empowerment, NGO, social
Maarifasasa	8	strong social orientation learning at scale for marginalized, social enterprise instead of NGO only to reach more scale, no girls focus
OwnLabs	6	desire to improve STEM education own experience, also business ambitions, only males in team, clearly no girls focus
Examsta	9	strong social orientation, provided for free, goal empower through education and getting students to the next step in their lives and strengthen communities, but prime focus continue schooling, next step in line with GMA not exactly GMA and no women focus, relationship helped students individually via WhatsApp pass their exams
Kolibri by Learning Equality	9	education and literacy for all (offline) not exactly GMA but great, provided for free to users OER, NGO from the US, no women focus
Mtabe	8	strong social orientation learning at scale for marginalized, unconnected main motivation, social enterprise, no girls focus
Eneza Education	8	mission to make 50 million African learners smarter, offline solution hence truly marginalized, no girls focus
Akiddie	10	values: Gender equality, inclusion, SDGs, tolerance, tech, entrepreneurship, financial literacy. None of these were themes covered by books like Cinderella and Rapunzel hence they created stories that did incorporate those values, empowered women, entrepreneurship and literacy also for women, cultural alignment tries to preserve African languages and stories, online but download functionality
Chalkboard Education	3	enabler to improve education and training programs, offline, original product doesn't involve content, profit-oriented, no gender focus, European founder
gradely.ng	6	reach 200 million children who are in school but not learning, comprehensive online solution improving education for students affluent enough to afford the required data, no women focus
Bookconekt	6	book club to enhance passion for books and literacy but mostly seller of books for profit, no particular social focus let alone on women
Ethale Books	6	comprehensive online solution improving education for students affluent enough to afford the required data, no women focus
2 Rabbits	9	empowering communities to maintain culture, grassroot initiative, NGO, no specific women focus
Classes.ng	3	comprehensive online solution improving education for students affluent enough to afford extra qualifications and the required data, no women focus
African Storybook	9	NGO, provided for free B2B2C, offline download function available, cultural alignment try to preserve African languages and stories
BrainShare	6	emphasized reaching the rural students, comprehensive online solution improving education for students affluent enough to afford the required data, no women focus, internet required and computers via B2B schools
Worldreader	9	NGO, provided for free B2B2C, offline download function available, cultural alignment try to preserve African languages and stories
RoboTutor	8	erase illiteracy among children in SSA, no girls focus, or value based etc. local deployment partners, not for profit (data for academic research)
PaperVideo	8	social enterprise: quality education for all, social mission by offering hardly profitable offline solutions as well as online, mention social motivation but profit- oriented and no girl focus
Clique	6	comprehensive online solution improving education for students affluent enough to afford the required data, no women focus
IDEA	9	female empowerment in examples and when expanding to new countries, localization important, so offline available just yet is negative
The Science Set	6	goal to trigger STEM interest in students to get them to university as more scientists and engineers are needed for the progress of the continent, target every child as no matter the school, practical STEM education is poor everywhere across Africa, no girl focus
M-Lesson	8	goal to reach children in off-grid communities who are not learning/ not at school due to e.g., child labour, offline solution hence truly marginalized, no girls focus
SUM	157	MEAN: 7,85

Business Name	Security Concerns	Security concerns no risk= 10, feature phone = 4 can be taken away and easy to repurpose but most have one
Maarifasasa	4	E-learning hub and VR only at GMA no risk, basic feature phones for B2C low-medium risk but as students mostly don't have
OwnLabs	9	Won't be used outside GMA campus/schools
Examsta	1	smartphone needed
Kolibri by Learning Equality	5	apps will be released soon/now for feature phones, before that no mobile version but any other device, other devices would have to be at campus as no one owns it hence medium
Mtabe	6	normal phone needed
Eneza Education	6	normal phone needed
Akiddie	3	smartphone/e-reader (a bit less attractive can't be repurposed) needed unless e-reader stays at GMA
Chalkboard Education	6	normal phone needed
gradely.ng	1	smartphone needed
Bookconekt	8	books: little value, unlikely, e-reader: won't be used outside GMA?
Ethale Books	3	smartphone/e-reader (a bit less attractive can't be repurposed) needed unless e-reader stays at GMA
2 Rabbits	10	won't be used outside GMA campus/schools, no value, can't be repurposed only educational material on it
Classes.ng	1	smartphone needed
African Storybook	8	e-reader: won't be used outside GMA
BrainShare	1	smartphone needed
Worldreader	3	smartphone/e-reader (a bit less attractive can't be repurposed) needed unless e-reader stays at GMA
RoboTutor	5	can't be easily repurposed but high valuable and desired tablet to be able to run software
PaperVideo	7	normal phone needed for offline or smartphone for online version
Clique	6	normal phone needed
IDEA	6	normal phone needed
The Science Set	8	Physical good that can only be used for experiments in Science, cost factor 15 USD fairly low
M-Lesson	6	normal phone needed
SUM	113	MEAN: 5,65

Business Name	Community Integration of Girlmovers	Community Integration of Girlmovers, Rolemodel/Changemaker = 10
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Maarifasasa	4	STEM experts/doctor profession/scientists, girls end up tutoring on marketplace themselves, digital literacy VR/AR, some potential there but no evident immediate options, incentive: Fun? / interest trigger through VR for STEM? What they can learn/create in the future
OwnLabs	3	STEM experts/doctor profession/scientists, digital literacy VR/AR, some potential there but no evident immediate options, incentive: Fun? interest trigger through VR for STEM? What they can learn/create in the future
Examsta	9	multiplier continuing education at college will affect community, good grades/passing, no further immediate community task/role/effect
Kolibri by Learning Equality	6	literacy experts in communities, spread the word on organic Kolibri adoption, no specific value
Mtabe	3	better grades/ higher chance of passing but not entertaining
Eneza Education	3	better grades/ higher chance of passing but not entertaining
Akiddie	10	girls could participate in digitizing cultural stories to preserve them, create stories for younger siblings with empowered girls, stories reading fun
Chalkboard Education	5	better grades/ higher chance of passing but not really entertaining depends on content design
gradely.ng	5	better grades/ higher chance of passing but not really entertaining depends on content design
Bookconekt	6	reading fun, improve literacy, girls' best readers in communities help others
Ethale Books	6	reading fun, improve literacy, girls' best readers in communities help others
2 Rabbits	3	better grades/ higher chance of passing but not entertaining
Classes.ng	3	Girls pass important tests such as exam entry exams for universities abroad and return afterwards to communities as social leaders, long-term impact promising
African Storybook	6	reading fun, improve literacy, girls' best readers in communities help others
BrainShare	5	better grades/ higher chance of passing but not really entertaining depends on content design
Worldreader	6	reading fun, improve literacy, girls' best readers in communities help others
RoboTutor	8	girls will be confident readers, important for daily life and phones
PaperVideo	5	better grades/ higher chance of passing but not really entertaining depends on content design
Clique	5	better grades/ higher chance of passing but not really entertaining depends on content design
IDEA	7	better grades/ higher chance of passing, really entertaining with customers motivational tokens for character etc. depends on content design
The Science Set	4	STEM experts/engineers' profession/scientists, girls can show and help others, incentive: Fun, interest trigger through VR for STEM? What they can learn/create in the future
M-Lesson	3	better grades/ higher chance of passing but not entertaining
SUM	115	MEAN: 5,75

Business Name	Localization potential	Localization potential
Maarifasasa	9	9 (very national top private schools, so far only in Uganda so examples and outer appearance fit, partner with local content developers to change existing curriculum) + working but not close relationship ministry of education
OwnLabs	6	one set of experiments per country from teacher network feedback, national not regional, can't be easily changed, but filmed in own high school/ marketing headset/school branding possible, mentioned national adaptation changes for expansion

Examsta	10	even adopted to both different national South African curricula due to content being USP
Kolibri by Learning Equality	7	with local partners, high importance, content needs to be changed
Mtabe	7	with local partners, high importance, content needs to be changed
Eneza Education	7	with local partners, high importance, content needs to be changed
Akiddie	10	local African languages (very small group) plus local stories need to be created as this is the point, Mozambican and Nigerian culture very different
Chalkboard Education	7	with local partners, high importance, content needs to be changed, examples and stories can be localized
gradely.ng	7	with local partners, high importance, content needs to be changed, examples and stories can be localized
Bookconekt	9	mostly international books, need to be translated/ books from lusophone Africa/international books in Portuguese added to stock
Ethale Books	10	local Mozambican languages, Mozambican authors, Mozambican venture - first of its kind with an e-reader app, partnership would enhance early tech ecosystem
2 Rabbits	7	with local partners, high importance, content needs to be changed, examples and stories can be localized
Classes.ng	3	rather agnostic through many international exam preparation courses
African Storybook	10	local African languages (very small group) plus local stories need to be created as this is the point, Mozambican and Nigerian culture very different
BrainShare	7	with local partners, high importance, content needs to be changed, examples and stories can be localized
Worldreader	9	mostly international books, need to be translated/ books from lusophone Africa/international books in Portuguese added to stock
RoboTutor	7	with local partners, high importance, content needs to be changed very difficult due to speech recognition
PaperVideo	7	with local partners, high importance, content needs to be changed, examples and stories can be localized
Clique	7	with local partners, high importance, content needs to be changed, examples and stories can be localized
IDEA	8	with local partners, high importance, content needs to be changed, avatars are changed, high importance to localized examples and stories can be localized
The Science Set	2	same set everywhere, maybe booklet/ few experiments/interpretations can be changed
M-Lesson	7	with local partners, high importance, content needs to be changed
SUM	163	MEAN: 8,15

Business Name	Internet Requirements	Internet Requirements: 1 = constant access, 10 = offline
Maarifasasa	10	VR: none 10, E-learning: 1 (no downloads), B2C: 1 (web-based application that is completely built for mobile, or downloads/offline features because mentioned "going back to the drawing board" after connectivity challenges)
OwnLabs	10	VR: none
Examsta	8	technically 1 as fully required but zero-rated by MTN but still connectivity needed so total 8
Kolibri by Learning Equality	9	none, except for occasional updates + data sync and initial download
Mtabe	10	none, SMS-based

Eneza Education	10	none, SMS-based
Akiddie	5	online library, but download of books possible, subscription online model
Chalkboard Education	9	none, except for occasional updates + data sync and initial download
gradely.ng	1	E-learning
Bookconekt	5	online library, but download of books possible
Ethale Books	5	online library, but download of books possible
2 Rabbits	10	offline as content downloaded onto device
Classes.ng	1	E-learning for exams, courses with constant online presence required
African Storybook	5	online library, but download of books possible
BrainShare	1	E-learning
Worldreader	8	online library, but download of books possible and zero rated in Ghana and South Africa but still connectivity needed
RoboTutor	10	downloaded onto device, occasionally helpers picked devices up for competition to harvest the data
PaperVideo	10	existing offline: micro-SD card + book but also online
Clique	1	E-learning
IDEA	1	E-learning
The Science Set	10	physical set
M-Lesson	10	none, SMS-based
SUM	149	MEAN: 7,45

Business Name	Content presentation: 10 = interest in subject triggered e.g., VR	Content presentation: 10 = interest in subject triggered e.g., VR
Maarifasasa	9	9 (VR, also sell courses (revenue share) so must be well-done, e-learning hub personalized but fun aspects not really mentioned)
OwnLabs	9	VR, fascinating, many insights and filmed in actual school, but really only MVP hence not 10

Examsta	9	less fun but in the most simple, strategic for long-term learning and effective way as this is the USP plus teaching background founder
Kolibri by Learning Equality	5	great content development toolkit, academic and pedagogical importance, not A* students covered
Mtabe	6	not great just content and repetition pedagogically
Eneza Education	6	not great just content and repetition pedagogically
Akiddie	7	no teaching aspect to it but books automatically enhance literacy but great illustrations even merchandise for story characters
Chalkboard Education	10	pedagogically: great SaaS, academically
gradely.ng	10	goal quality learning to get children to learn who are in school but don't learn, personalized learning concept, all subjects age groups comprehensive solution, close teacher collaboration
Bookconekt	7	no teaching aspect to it but books automatically enhance literacy and book club to discuss readings
Ethale Books	7	no teaching aspect to it but books automatically enhance literacy and book club to discuss readings
2 Rabbits	8	content pedagogically great, not many individual tasks possible just one device per class more aid for teachers who are being trained by professionals though
Classes.ng	3	just platform, content outsourced to exam preparation providers
African Storybook	7	no teaching aspect but automatically enhancement of literacy plus many illustrations
BrainShare	7	digitized textbooks and exercises,
Worldreader	7	no teaching aspect but automatically enhancement of literacy plus many illustrations
RoboTutor	10	academic ventures so pedagogically great "grandparents who never loses patience" extensively piloted and speech recognition feature
PaperVideo	10	quality education for all goal, all subjects age groups comprehensive solution, close teacher collaboration online solution great net of content and even offline (QR code scan) to revise in different ways content that hasn't been understood properly

Clique	10	Pedagogically: templates and support to digitize it and make it more fun, get other teachers and tutors to sign up for individual, personal help for students etc
IDEA	10	pedagogically: amazing animations, localized, different types of contents and little incentives through personalized avatar and counting of points etc emphasis fun but not too fun still needs to be learning environment
The Science Set	9	pedagogically: amazing as individual practical experience for learners, taught via video and book good but problem what if students don't understand it CIA but not perfect,
M-Lesson	6	not great just content and repetition pedagogically
SUM	172	MEAN: 8,1

Business Name	Affordability B2B perspective including hardware, 10= OER	Affordability B2B perspective including hardware, 10= OER
Maarifasasa	4	own various revenue sources, bootstrap approach but hardware/e-learning hub VERY expensive (2), subscription B2C cheap between 5,80 & 8,15 EUR monthly benchmarked to public education costs often heavily subsidized or sponsored by corporates for rural marginalised students (8)
OwnLabs	2	mentioned very expensive, will only target richest private schools who can afford it, though partnership FB Africa and corporates envisioned
Examsta	9	currently handed out for free as founder works additional, main motivation: intrinsic, not 10 because content developers would have to be hired to translate to Portuguese & Mozambican curriculum as for now, founder wouldn't pay for that
Kolibri by Learning Equality	9	open-source, organic adoption some content in Portuguese from Brazil but not much and needs adoption
Mtabe	9	0.6 USD a month for Q&A core subjects, only few feature phones at around 10 USD need to be bought
Eneza Education	9	0.5 USD a month for Q&A core subjects, only few feature phones at around 10 USD need to be bought
Akiddie	6	B2C: subscription costs (but B2B available): 1.3USD monthly for 20 books, smartphones/e-readers required though, translation required and stories according to their culture
Chalkboard Education	8	Saas and only B2B to NGOs probably upper affordable price range, hardware works on feature phones offline
gradely.ng	5	individual subscriptions parents pay smartphone
Bookconekt	5	individual book purchases/ subscriptions e-library parents pay smartphone
Ethale Books	5	individual book purchases/ subscriptions e-library parents pay smartphone
2 Rabbits	7	devices around 70USD serve an entire class, teacher education probably costly but not necessary maybe in GMA context, that's all costs covered once content created
Classes.ng	5	depends on course enrolled for, but rather urban wealthy target group investing in additional exams
African Storybook	5	individual book purchases/ subscriptions e-library parents pay smartphone
BrainShare	5	individual subscriptions parents pay smartphone
Worldreader	5	individual book purchases, e-library free as NGO? smartphone

RoboTutor	4	NGO/ Research free but workload translate content would be very pricey
PaperVideo	8	individual subscriptions parents pay smartphone for online solution but for offline solution + book a few features phones need to be bought and offline solution half the price once
Clique	5	individual subscriptions parents pay smartphone
IDEA	5	individual subscriptions parents pay smartphone
The Science Set	9	no hidden costs only set need to be bought at 15USD each
M-Lesson	9	nothing mentioned but only SMS reading + operations on feature phones required (very basic)
SUM	138	MEAN: 6,4

Business Name	Experience Ventures, 10 = multiple countries, many years active, awards, African solution	Experience Ventures, 10 = multiple countries, many years active, awards, African solution
Maarifasasa	7	5: 2018, AFRICAN solution, many international reputable partnerships, so far only Uganda but deployed in east African countries awards: listed briter bridges report EdTech Uganda
OwnLabs	5	only in Senegal and MVP, AFRICAN solution, diverse motivated founder team international studies, winner renowned Orange Tech start-up award Senegal, government partnership
Examsta	5	early stage, first pilot done March 2020, won MTN awards hence zero-ratedness, South Africa only but soon expansion to Nigeria & Ghana, South African solution
Kolibri by Learning Equality	9	active many years, enormous experience and partner network but not AFRICAN solution compensated through network as fully aware of that, active in most African countries and in many outside,
Mtabe	8	second EdTech venture, 10+ years EdTech in Africa experience founder, AFRICAN venture, many awards including one by the Queen, expansion plans neighbouring countries within next 3 years
Eneza Education	10	African venture, active in 4 African countries including language switch French for Ivory coast, active 10 years, recognized as best on map by Briter Bridges top funded category e-learning and tutoring
Akiddie	5	young African start-up, received some funding but lacking some for large scale, active in Nigeria but online so users from 40+ countries
Chalkboard Education	8	Ghana & ivory coast, but projects supported also in Ghana and Uganda, orange start-up stories, 6 years since foundation
gradely.ng	7	Award EdTech summit for most adaptive solution, 7,500+ students, 1,200+ teachers, only Nigeria, founded 2019, African solution
Bookconekt	5	young African start-up, recognized by AU best social entrepreneurs, founder reputable scholarship holder, received some funding but lacking some for large scale, active in Benin but online so customers from numerous countries
Ethale Books	7	only in Mozambique, but active for many years, enormous experience in the literary field especially African literature
2 Rabbits	4	only in Cameroonian forest indigenous population, US-based NGO with local partner NGO in charge of operations, active several years
Classes.ng	4	young African start-up only in Nigeria
African Storybook	10	active since 2013, AFRICAN solution (from south Africa) presence, through partners in Cameroon, Ethiopia, Kenya, Nigeria, Ghana, Malawi, Zambia, Mozambique, South Africa, Uganda, Zimbabwe, Rwanda, Tanzania and Benin. 221 Languages 1859, Storybooks 6601 Translations,
BrainShare	9	African solution, active in 4 countries all national language English: Uganda, Kenya, Tanzania, Rwanda, founded in 2012, the start-up won the MTN Innovation Awards in the "best educational app" category
Worldreader	9	active many years, enormous experience and partner network but not AFRICAN solution compensated through network as fully aware of that, active in most African countries and in many outside,

RoboTutor	8	not African but US based and academic orientation, finalist and successful pilot results for renowned Global X Prize competition with 1 million USD funding received plus great network, only selected Tanzanian villages and Swahili + English-speaking countries
PaperVideo	8	South Africa, Canada looking into expanding to Kenya, founded 2014, seed funding from the Millennium Trust, backed by some of South Africa's leading brands.
Clique	5	Nigeria, active in, language challenge recognised
IDEA	8	2019 finalist GESA awards, working with government, from South Africa, active in countries,
The Science Set	9	active in Ghana and UK mainly but customers in 40+ country, looking into large-scale expansion and setting up factories, supported by e.g. GIZ Make IT in Africa and won many awards, truly African solution
M-Lesson	5	mentioned strong interest as none is there but first priority setting up MLesson and low handing fruits anglophones
SUM	155	MEAN: 7,2

Business Name	Support with Digital Literacy, 10 = best support measures	Support with Digital Literacy, 10 = best support measures
Maarifasasa	9	9 mentioned learning assistants on demand in e-learning hubs, Digital Skills and ICT training Offline (on-site trainings) and Online synchronous and asynchronous trainings.
OwnLabs	3	nothing much mentioned, probably integrated explanations in program
Examsta	2	nothing mentioned, since internet required solution and from rather developed south Africa, probably solutions assume existence of basic digital literacy among users
Kolibri by Learning Equality	5	nothing much mentioned, probably integrated explanations in program, toolkit boxes with explanations for teachers how to set it up
Mtabe	9	nothing mentioned but only SMS reading + operations on feature phones required (very basic)
Eneza Education	9	nothing mentioned but only SMS reading + operations on feature phones required (very basic)
Akiddie	7	nothing mentioned about help/explanation but only few skills required to download and purchase book
Chalkboard Education	10	Onboarding tutorial designed for low tech-literacy users
gradely.ng	2	nothing mentioned, since internet required solution and target customers more digitally skilled and educated, probably solutions assume existence of basic digital literacy among users
Bookconekt	7	nothing mentioned about help/explanation but only few skills required to download and purchase book
Ethale Books	7	nothing mentioned about help/explanation but only few skills required to download and purchase book
2 Rabbits	9	basic skills required but support for aspiring teachers how to use the MP3 device
Classes.ng	2	nothing mentioned, probably high digital literacy assumed
African Storybook	7	nothing mentioned about help/explanation but only few skills required to download and purchase book
BrainShare	7	nothing mentioned about help/explanation but only few skills required to download and purchase schoolbook, children know how to work with the books and exercises
Worldreader	7	nothing mentioned about help/explanation but only few skills required to download and purchase book
RoboTutor	10	extensive workarounds for children without any digital skills starting from login with pictures and voice explaining what to do, working with colour schemata etc.

PaperVideo	10	partnerships with schools only B2B for offline close contact to them keep supporting them in implementation and same for online more advanced schools as without support particularly in first weeks they realized teachers stopped using it and dont see the benefit
Clique	2	nothing mentioned, since internet required solution and target customers more digitally skilled and educated, probably solutions assume existence of basic digital literacy among users
IDEA	9	a lot of support for teachers and school particularly at implementation for them to really adopt it and understand advantages, teacher champions to help the others at each school
The Science Set	10	set doesnt require digital skills, video explanations how to use it/ booklet pretty basic, CIA to help
M-Lesson	5	feature phone: 5 (only 6% own one, but lower robbery risk as most people own them, not as valuable
SUM	148	MEAN: 6,95

Business Name	School improvement	School improvement: 10 = level best private school
Maarifasasa	10	10: since goal quality education for all from top-notch private schools, inspiration internationally, reaching for the stars and well-thought through, all subjects age groups comprehensive solution
OwnLabs	7	not comprehensive, only few experiments no major content not all but relevant improving interest, pedagogically excellent academically great
Examsta	9	great pedagogically, academically not for A* students nor very interesting practical stuff etc but content presented in great way, revision strong etc. as teaching expert USP
Kolibri by Learning Equality	8	great content development toolkit, academic and pedagogical importance, not A* students covered?
Mtabe	6	not great just content and repetition pedagogically, academically not for A* students nor very interesting, no practical stuff etc and basic content
Eneza Education	6	not great just content and repetition pedagogically, academically not for A* students nor very interesting, no practical stuff etc and basic content
Akiddie	4	no teaching aspect to it but books automatically enhance literacy
Chalkboard Education	5	pedagogically: great SaaS, academically no content on basic product hence can't be rated
gradely.ng	10	goal quality learning to get children to learn who are in school but don't learn, personalized learning concept, all subjects age groups comprehensive solution, close teacher collaboration
Bookconekt	4	no teaching aspect to it but books automatically enhance literacy
Ethale Books	4	no teaching aspect to it but books automatically enhance literacy
2 Rabbits	8	great pedagogically designed by teaching experts but no personalized features, teachers are trained by NGO lead by teaching experts, academically focussing on basics and national language, nor very interesting practical stuff etc but content presented in great way
Classes.ng	5	depends on exam preparation provider, but great that training for those exams is made possible to allow further education abroad
African Storybook	4	no teaching aspect to it but books automatically enhance literacy
BrainShare	7	digitized textbooks and exercises.
Worldreader	4	no teaching aspect to it but books automatically enhance literacy
RoboTutor	10	academic ventures so pedagogically great "grandparents who never loses patience" extensively piloted and speech recognition feature
PaperVideo	10	quality education for all goal, all subjects age groups comprehensive solution, close teacher collaboration online solution great net of content and even offline (QR code scan) to revise in different ways content that hasn't been understood properly
Clique	8	Academically: own content but get templates and existing basic content staff, Pedagogically: templates and support to digitize it and make it more fun, get other teachers and tutors to sign up for individual, personal help for students etc
IDEA	10	quality education for all goal, all subjects age groups comprehensive solution, close teacher collaboration pedagogically: amazing animations, localized, different types of contents and little incentives through personalized avatar and counting of points etc emphasis fun but not too fun still needs to be learning environment

The Science Set	8	pedagogically: amazing as individual practical experience for learners, taught via video and book good but problem what if students don't understand it CIA but not perfect, academically includes all relevant experiments K-12
M-Lesson	7	not great just content and repetition pedagogically but mentioned personalized learning, academically not for A* students nor very interesting, no practical stuff etc and basic content
SUM	154	MEAN: 7,7

Business Name	Personal Hardware Requirements	Personal Hardware Requirements: 10 = none, 5 = feature phones, 3 = smartphone, 1 = computer
Maarifasasa	2	3-4 (VR, e-hub would be equal to 10 but also app for smartphones? 3(in other countries), feature phone: 5 (only 6% own one, but lower robbery risk),
OwnLabs	10	none
Examsta	5	phones, web-based application with internet so possibly smartphone
Kolibri by Learning Equality	5	feature phones soon as app is soon publicly available, otherwise all other device which are mostly though not used in marginalized communities etc only possible in hubs
Mtabe	5	feature phone: 5 (only 6% own one, but lower robbery risk as most people owns them, not as valuable
Eneza Education	5	feature phone: 5 (only 6% own one, but lower robbery risk as most people owns them, not as valuable
Akiddie	3	smartphones/e-readers
Chalkboard Education	5	feature phone: 5 (only 6% own one, but lower robbery risk as most people owns them, not as valuable
gradely.ng	3	smartphones/tablets
Bookconekt	3	smartphones/tablets
Ethale Books	3	smartphones/tablets
2 Rabbits	10	none
Classes.ng	3	smartphones/tablets
African Storybook	3	smartphones/tablets
BrainShare	3	smartphones/tablets
Worldreader	3	smartphones/tablets
RoboTutor	10	none
PaperVideo	5	feature phone: 5 (only 6% own one, but lower robbery risk as most people own them, not as valuable
Clique	3	smartphones/tablets

IDEA	3	smartphones/tablets
The Science Set	10	none
M-Lesson	5	feature phone: 5 (only 6% own one, but lower robbery risk as most people owns them, not as valuable)
SUM	107	MEAN: 5,35

Business Name	Interest in Mozambique, 10 = Local	Interest in Mozambique, 10 = Local
Maarifasasa	4	4: eventually all of Africa but language priority 4 but pilot Angola
OwnLabs	3	will depend on opportunities, governments and general attitude towards technology, before never considered it but open to opportunities with matching partner
Examsta	2	not paying for it herself if funding is taken care of possibly, also first expansion planned to other anglophone African countries as those are very similar
Kolibri by Learning Equality	10	former pilot there, at the moment considering it, true knowledge about it, some Portuguese content and portuguese speakers on the team
Mtabe	5	first to neighbouring anglophone countries within next 3 years, said they considered it, but no specifics came to mind
Eneza Education	5	theoretically always interested in expanding stated haven't seen any competitors expanding there, no specific knowledge
Akiddie	5	stated strong interest, mentioned flexible in terms of languages and content, online solution (but before didn't look into Mozambique/no in-depth knowledge)
Chalkboard Education	5	stated strong interest, mentioned flexible in terms of languages and content, online solution (but before didn't look into Mozambique/no in-depth knowledge)
gradely.ng	4	stated interest and having some individual users from there since online solution, mentioned flexible in terms of languages and content and eventually all of Africa but currently limited resources need to be strategic, looks at numbers Mozambican market or project and probably rather anglophone countries first (but before didnt really look into Mozambique/no in-depth knowledge)
Bookconekt	5	stated strong interest, books in Portuguese need to be acquired, online solution makes them flexible (but before didnt look into Mozambique/no in-depth knowledge)
Ethale Books	10	Mozambican venture, active
2 Rabbits	7	not interested in growing further with Baka communities but expanding model to different areas yes but only if partner found that truly matches their values, no specific knowledge of Mozambique,
Classes.ng	2	nothing mentioned, not very suitable
African Storybook	10	We have a partner/s who work in Mozambique and use our resources. Little Zebra is our partner and also contributes storybooks in Portuguese and other local languages used in Mozambique.
BrainShare	5	first to neighbouring anglophone countries, said they considered it but no specifics came to mind
Worldreader	2	not within the next 5 years in their strategy
RoboTutor	1	speech recognition very challenging to translate now in Swahili and English, first anglophone then possibly French Portuguese-speaking countries, Mozambique end of the list no knowledge about the EdTech market there
PaperVideo	4	very open to expanding to a new country, criteria how educational infrastructure looks like, no knowledge about Mozambique heard only poor things about general infrastructure and assumes that extends to educational infrastructure
Clique	3	not considered it, first anglophone then possibly French Portuguese-speaking Mozambique end of the list no knowledge about the EdTech market there
IDEA	5	haven't really looked into it first associations that came to mind negative: poor digital infrastructure but generally interested in expanding to new country that could also be Mozambique

The Science Set	6	stated strong interest, books in Portuguese need to be acquired, online order/ video content makes them flexible+ shipment globally (but before didn't look into Mozambique/no in-depth knowledge)
M-Lesson	5	theoretically always interested in expanding stated haven't seen any competitors expanding there, no specific knowledge
SUM	108	MEAN: 4,55

Business Name	Pilot Ease & Cost, cheap + local = 10	Pilot Ease & Cost, cheap + local = 10
Maarifasasa	5	5 (currently piloting in Angola) marketplace app cheap, hub & especially VR glasses very expensive
OwnLabs	1	experiments and language adaptation 30 sets deposit need to be bought even within same school and country
Examsta	4	no extra costs probably comany as rather NGO/intrinsic motivation, translation required + content developers MOZ, no hardware costs etc, but deal extension zero-ratedness, different telecommunication provider, Vodacom open to respective projects but slow
Kolibri by Learning Equality	7	OER cheap; previous pilot done in Mozambique, intrinsic motivation before, Portuguese content, but no specific Mozambican content, soon available as an app but smartphone so hardware purchase
Mtabe	8	hardware: 96% of participants need feature phones which are very cheap, content translation into Portuguese + adaptation curriculum not too complicated BUT telco collaboration hence needs according to Eneza for SMS-based strategic medium-term planning unlike online
Eneza Education	8	hardware: 96% of participants need feature phones which are very cheap, content translation into Portuguese + adaptation curriculum not too complicated BUT telco collaboration hence needs according to Eneza for SMS-based strategic medium-term planning unlike online
Akiddie	8	no books in Portuguese available, Mozambican stories would have to be written down/ created, but other than that online venture, already customers in most African countries, no Mozambican office even required, smartphones or e-readers required
Chalkboard Education	6	just subscription needs to be bought, content set up by GMA themselves, translation LMS into Portuguese, & hardware at least smartphones need to be bought for all GMAs
gradely.ng	6	subscription needs to be bought, content needs Mozambican adaptation and translation into Portuguese, & hardware at least smartphones need to be bought for all GMAs
Bookconekt	8	no books in Portuguese available but other than that online venture, already shipment across the globe, only one person responsible in Mozambique required, smartphones/ e-readers required
Ethale Books	10	available in Portuguese and local languages in Mozambique as local venture, only purchase of phones needed, download app simple, costs around 1-2 euro per book
2 Rabbits	8	Hardware with content on it just one for an entire class at 70 USD fairly cheap, content needs to be created but just audio so not a lot of work/time, but possibly teacher training time-consuming
Classes.ng	8	marketplace, online available, lessons probably also online available but in English
African Storybook	10	Active in Mozambique through local deployment partner, languages available, NGO so solution should have reasonable pricing
BrainShare	8	digitize/translate Mozambican textbooks (quick and cheap) + provide hardware devices at least smartphones
Worldreader	9	fairly easy but no books in Portuguese available, Mozambican stories would have to be written down/ created, but other than that online venture, already active in many African countries, Durable devices that last for weeks on a single charge: Blue box program 15k could be tried: 5,000 books, 50 durable e-readers and support
RoboTutor	2	speech recognition very time-consuming and costly to translate into Portuguese, hardware tablets need to be bought for all
PaperVideo	9	subscription needs to be bought, content needs Mozambican adaptation and translation into Portuguese, & hardware at least smartphones need to be bought for all GMAs
Clique	6	just subscription needs to be bought, content set up by GMA themselves, translation LMS into Portuguese, & hardware at least smartphones need to be bought for all GMAs

IDEA	6	subscription needs to be bought, content needs Mozambican adaptation and translation into Portuguese, examples, characters etc need cultural adaptation & hardware at least smartphones need to be bought for all GMAs
The Science Set	9	only translation of videos/book into Portuguese plus sets need to be bought cheaply including hardware and solution, training/finding one CIA
M-Lesson	8	hardware: 96% of participants need feature phones which are very cheap, content translation into Portuguese + adaptation curriculum not too complicated BUT telco collaboration hence needs according to Eneza for SMS-based strategic medium-term planning unlike online
SUM	152	MEAN: 6,7

APPENDIX 14: BENCHMARK: Interview partner

Business Name	Person interviewed	Position
Maarifasasa	Robert Bob Okello	CEO
OwnLabs	Mouhamed SECK	Head of Operations and Business Development
Examsta	Marie de Wet	CEO
Kolibri (former KA Lite) by Learning Equality	Lauren Lichtman	Partnerships Lead
Mtabe	Given Edwards	Founder
Eneza Education	Joan Njogu	Head of Commercial Operations
Akiddie	Dominic Dominic Onyekachi	CEO and Co-founder
Chalkboard Education, Ghana	Adrien Bouillot	CEO and Founder
gradely.ng beta	Boye Oshinaga	CEO and Co-founder
Bookconekt	Augustino Agbemavo	CEO and Founder
2 Rabbits	Sarah Strader	CEO and Founder of US-based operations NGO
M-Lesson	Johannes Oula	Founder and Ceo
Classes.ng	Daniel Osi	CEO
African Storybook	Dorcas Wepukhulu	Coordinator for Kenya and Ethiopia
BrainShare	Charles Muhindo	CEO
Worldreader	Selena Garrahan, regional director of East Africa	Communications Manager at Worldreader, for Mozambique part
RoboTutor	Jack Mostow	Team Leader, RoboTutor, \$1M Finalist in the \$15M Global Learning XPRIZE
PaperVideo	Christopher Mills	CTO and Co-founder

Clique	Abdulrazak Lawal	Co-founder and Marketing lead
IDEA	Jackie Chikambure	People Operations Manager at IDEA
TheScienceSet	1. Charles Ofori 2.Mawuli Kobla Amedofu	1. CEO and Founder 2.Supply chain lead and Business consultant
The Dr. C.L. Smith Foundation, South Africa: Zibuza (Outside Benchmark)	Malcolm Mooi	CEO
we think code (Outside Benchmark)	Nyari Samushonga	CEO
Ethale Books (Benchmark, Mozambique)	Alex Macbeth	CEO and Founder
GYPA (Mozambique Part 4)	Keith Honwin	Founder and CEO
Olenvo (Mozambique Part 4)	Zélio Nelson	Co-founder
Atingi/ Industry Expert	Dominic Orr	OER Senior Educational Adviser at OECD, UNESCO, World Bank, GIZ and atingi founder
Industry Expert	Filipo Gao Lubua	Expert interview, PHD in instructional technology, Volunteer at Robo Tutor (not representing them), Tanzanian

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