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Business model framework for education technology entrepreneurs in South Africa

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Background: Education technology (EdTech) has been proven to make a positive impact on education outcomes in developed economies. There is an immense untapped opportunity to introduce more EdTech into the basic education ecosystem to help with the education crisis in South Africa.

Aim: This study aimed to develop a framework that can be used to identify key considerations for EdTech entrepreneurs to create sustainable ventures.

Setting: The South African Government issued a clear e-Education policy white paper in 2004, but not enough progress has been made to improve education. The EdTech entrepreneur is the entity in the education ecosystem with the highest level of agility to take on this opportunity, if properly positioned and supported.

Methods: A multi-case study approach explored inputs from small business EdTech entrepreneurs. Qualitative analysis compared empirically based results, as identified themes with three predicted propositions.

Results: Four themes emerged: mature product, complex support network, multiple infrastructure considerations and multiple sources of revenue. The findings confirmed teacher distrust as having the greatest impact on value creation, mobile networks as only one of the key impacts on value delivery and both private and public sectors providing value capture opportunities.

Conclusion: Education technology entrepreneurs should develop mature products that teachers can endorse; build a support network, which would include an advisory board and low-cost infrastructure providers; and source multiple revenue streams from the private and public sectors. Better government policy and procurement implementation would also enhance the provision of simpler and predictable revenue streams to EdTech providers.

Keywords: basic education; K-12; education technology; EdTech; e-learning; entrepreneurship; business model framework; sustainable ventures; South Africa.

Introduction

Education quality is a vital input for economic growth (Hanushek & Woessmann 2010). South Africa is an emerging economy with a low quality of basic education (Department of Basic Education [DBE] 2019; Spaull 2013; World Economic Forum [WEF] 2017), where an improvement in the quality of education along with rapid investment in entrepreneurship potentially has a major positive transformational impact (Naudé 2017). While an improvement in tertiary or higher education is very important, and is linked to creating a higher level of skills to drive economic growth, the foundation is laid with basic education.

The term Fourth Industrial Revolution was introduced to describe the latest era of rapid technological change in the world (Schwab 2017), bringing with it the opportunity of harnessing technology to support education with proven positive outcomes (Mihai 2017; Pandey & Tiwari 2014; Tamim et al. 2011). The global education technology (EdTech) market has a market capitalisation of more than US$220bn, which includes an investment in basic education, or K-12, of more than US$68bn over the last decade (HolonIQ 2020). Solving the education crisis in South Africa requires much more than just an EdTech intervention. While this is acknowledged, it does not detract from the opportunity for EdTech to contribute positively to this direly needed improvement, especially as the demand for education continues to outgrow the creation of teacher capacity.

The South African DBE recognised the opportunity, and as a result released a white paper on e-Education entitled *Transforming Learning and Teaching through Information and Communication*

Technologies (ICTs) (DBE 2004) that identified various capacity constraints that limit ICT delivery, and called for the public and private sectors to work together. Entrepreneurship drives economic growth in Africa (Adusei 2016), and is increasingly defined as acting on an opportunity (Eckhardt & Shane 2003; Eisenmann 2013) using innovation as its instrument (Drucker 1993:30). These innovation opportunities can have multiple sources, including process need and changes in market structure (Drucker 1993:35) and are often fostered through new knowledge in science and engineering (Beckman et al. 2012). The EdTech entrepreneur is the entity in the ecosystem with the highest level of agility to take on such an opportunity, if properly positioned and supported.

By developing a framework that identifies key considerations for sustainable EdTech entrepreneurship in an emerging economy, this study seeks to answer the question: 'How can South African EdTech entrepreneurs be better supported in the EdTech value network?'

Conceptual model

Business model frameworks provided the foundational construct for developing the conceptual model to guide this study, as 'business models emphasize a system-level, holistic approach to explaining how firms do business' (Zott, Amit & Massa 2011:1019). In recent years, companies have increasingly needed to cope with rapid change to be successful, which has led to the use of the shorter version business model canvas (BMC), with Ladd (2018) confirming that the use of the BMC drives venture success.

The BMC of Osterwalder and Pigneur (2010) has a simple structure and is widely used, but lacks the ability to map relationships between the nine blocks in their model and the external environment. The lean BMC by Maurya (2010) has similar strengths to those of the Osterwalder and Pigneur's BMC, although the replacement of partners and customer relationships blocks exacerbates the weakness of not mapping all relationships in the stakeholder or value network.

Petheő and Vecsenyi (2018) introduced a business concept map in 2011 as an alternative to the 2010 canvases, and Noga (2015) extended the canvas with two additional components, investors and exits**.** Both models have the strength of being more comprehensive, specifically in adding funding and financing information directly into the model; but both have the weakness that they can be overly complex. Joyce and Paquin (2016) developed a triple-layered BMC with layers for economic, environmental and social aspects. This model has the strength that it adds non-economic dimensions to consider – something that is particularly relevant for the EdTech industry; but, like the previous two models, it has the weakness that these additional layers make the overall model more complex.

Models focused on e-learning include that of Nagle and Golden (2007), based on the Osterwalder and Pigneur 2005 BMC, and adding the specific view that one of the core competencies to consider as an e-learning provider is pedagogical method and knowledge. Di Valentin, Werth and Loos (2014) built a complex model that covers detailed business model element categories that are specific to e-learning companies for value offering, partnerships, market, strategy and financials.

Another view on business models is the value-based perspective of Rezazadeh and Carvalho (2017), in which five types of business model innovation are proposed that are focused on value creation, value proposition, value delivery, value capture and value network. Badhani and Mut (2017) built a business model innovation framework that follows a very similar categorisation, and focuses on building a map of the overall value network. The strengths of this model are that it simplifies the core business model components even more, and focuses on the relationships of stakeholders in the value network. Its weakness is that it oversimplifies the business model components, which could detract from detailed insights into business model element challenges.

The main gap in the literature relates to testing the models focused on EdTech with empirical data (Barzak 2017; Di Valentin et al. 2014): the Barzak study is not focused on the basic education customer segment, and these models have not been tested in an emerging economy such as South Africa. However, the study by Badhani and Mut (2017), and that by Mattsson and Andersson (2019), which followed to include public sector inputs, do test their models with empirical data, and so provide a key input into the model for this study. They relate the business model to the value network by grouping components from the BMC into four value constructs – that is, value proposition, value creation (partners, activities and resources), value delivery (channels, customer relationships and segments) and value capture (cost structure and revenue streams). The conceptual model in this study adds 'funding' to the value capture construct, and investigates value proposition under the value capture construct, simplifying the model to three value constructs.

The conceptual model in Figure 1 combines the principles of the existing models not only with a specific focus on the value network, but also with sufficient insight into the company business model. The three propositions are represented in this model by P1 to P3. The EdTech entrepreneur is at the centre of the model.

The dotted lines in this model (Figure 1) represent the interactions or value flows. The investigation into these interactions was constructed in such a way that insights into the dynamics in the value network would emerge and also provide insights into the business model challenges for EdTech ventures. The value network was explored by identifying the complete set of stakeholder relationships and then focusing on the main stakeholders in each of the value constructs. At the time of constructing the conceptual model, the key stakeholders were understood to be mobile networks

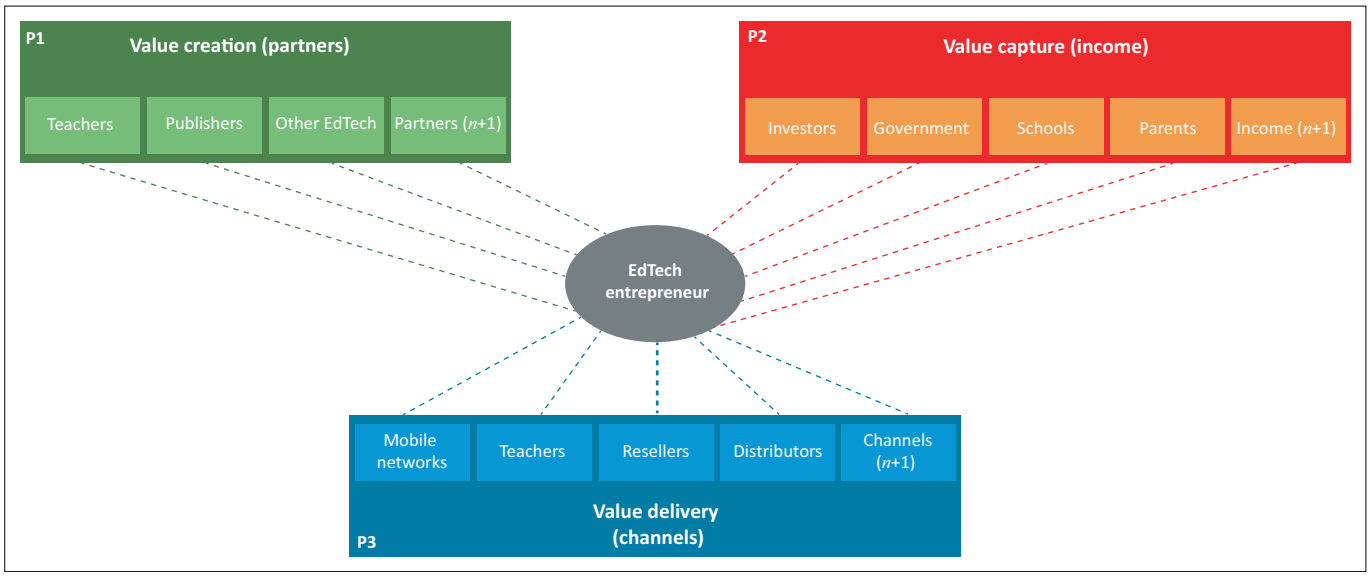

FIGURE 1: Conceptual model for education technology entrepreneurship.

in 'value delivery', teachers in 'value creation' and government, as well as investors, in 'value capture'.

Three propositions were formulated to cover the three value constructs, with a focus on the key stakeholders in each of these areas.

Proposition 1: Teacher distrust has the greatest impact on value creation. The relationship between the EdTech entrepreneur and the educators or teachers in the value network was one of the key aspects to investigate, as educators can have a direct impact on the most relevant EdTech being applied in order to have a sustainable impact (Kanthawongs & Kanthawongs 2013; Social 2009; Vandeyar 2013). Addressing teacher distrust in EdTech forms part of the culture transformation challenge listed by the government's white paper (DBE 2004).

Proposition 2: Investor scepticism and government revenue streams have the greatest impact on value capture. In South Africa, a large percentage of schools are fully funded by government, which leads to the argument that the suggested business model for EdTech should consider revenue from government or other revenue streams to subsidise the bulk of this customer segment with low revenue potential. A wider customer landscape should be investigated (Taran, Boer & Lindgren 2015) to feed into diverse revenue stream opportunities (Gundry & Welsch 2001; Pretes 2002). When revenue streams are not very clear, then investors are typically quite sceptical about investing in related ventures, as there is no clear monetary return on investment.

Proposition 3: Mobile network zero rating has the greatest impact on value delivery. A telecommunications provider, especially a mobile network operator, can provide the underlying technology enablement for EdTech in an emerging economy that has a lack of infrastructure. Education technology is more accessible to learners over mobile networks (Walls et al. 2015) – even more so if data usage is not charged. Studies have shown benefits and improved results from having access to mobile technologies to support learning (Sandberg, Were & Sutherland 2011; West 2013). These networks offer alternative opportunities for payment collection (Mpala 2019), especially when the provider offers low transaction fees.

Research design and methods

A literature review was used to formulate the conceptual model, followed by a qualitative case study approach. A qualitative research approach for 'exploring and understanding the meaning individuals or groups ascribe to a social or human problem' (Creswell 2014:4) was selected to gather a rich set of data to gain detailed insights into the challenges for EdTech entrepreneurs. The case study is a valid data-gathering technique because of the exploratory nature of the research questions (Yin 2014). Specific propositions were developed from the conceptual model to focus on the scope of the study (Baxter & Jack 2015).

Data gathering and case selection

The data gathering was primarily driven by semi-structured interviews, as the COVID-19 pandemic hampered the effective use of alternative qualitative instruments like participant observations and focus group interviews. The cases that were selected were South African EdTech entrepreneurial companies that were serving a basic education segment, that had been in existence for at least five years, and that were small to medium enterprises (10 to 100 employees). The reason for selecting companies that were older than five years was that they had been able to sustain themselves somehow, and would also have valuable insights based on their experience over a longer period of time than new start-ups. It was not viable to consider a longitudinal study over multiple years because of the time constraints of this research.

A multi-case study approach was chosen to improve the certainty of the results. Although there are multiple stakeholders in the EdTech value network, the data collection was aimed at EdTech entrepreneurs, as they are central to the value network and so should be able to provide data on all the value flows in the network.

A company search of 'e-learning South Africa' on LinkedIn returned 214 results. Each of these results was scanned, but with almost none found in the target population – that is, the results included educational institutions, tutors, resellers of international EdTech, etc. A subset of these results alongside a further extensive search on the internet of conference proceeding notes, trade show agendas, news feeds and incubator websites resulted in fewer than 20 EdTech companies with a basic education customer segment, of which at least three were focused on devices such as smart whiteboards, which did not fit the focus of this study. Five companies participated in the study, with two having been identified through the snowball technique (Saunders, Lewis & Thornhill 2019:323).

Data analysis

A pattern-matching analytic generalisation technique was used on the primary data by comparing empirically based results as identified themes with predicted propositions. This was done by capturing all the data in a qualitative analysis tool called Atlas.ti, coding the data and inferring themes from the coded data via a thematic analysis process (Braun & Clarke 2006).

The findings of this exploratory research provided conclusions based on comparing identified themes with three predicted propositions, and provided input to the development of a framework.

Ensuring quality and trustworthiness

Trustworthiness in qualitative research includes dependability, credibility, transferability and authenticity (Saunders et al. 2019:217). Recording and transcribing the interviews enhanced dependability and credibility. Construct validity was improved by using triangulation – in this case, by comparing interview responses from multiple respondents where possible. Internal validity was less of a concern, as the aim of this study was not to explain causal relationships. Nonetheless, pattern matching was used to confirm the validity of the empirical results. Replication logic was used across multiple case studies to confirm external validity, or transferability. By strictly adhering to the answers and comments of the participants, authenticity was ensured.

Ethical considerations

Ethical clearance was obtained from the ethics committee of the Faculty Engineering, Built and Information Technology, University of Pretoria (EBIT/132/2020), 24 July 2020.

Results

Four themes emerged from the thematic analysis of the coded data, as shown in Figure 2: mature product, complex support network, multiple infrastructure considerations and multiple sources of revenue.

Theme 1: Mature product

Student and parent product endorsements play an important role; however, multiple respondents commented on teacher endorsement as being most important. As one respondent said:

> 'They can be quite critical, and rightfully so, of anything new coming into their environment. … So if they endorse something that's poor quality that will reflect on them. … Once schools trust your product, they typically embrace it quite rigorously.' (Participant 1, CEO, 2020-08-31)

A mature product will not only be a key consideration for the teachers, but, if endorsed, it will also open doors for it to be widely embraced. The alternative view on how things can go wrong when teachers are not 'on board' with a product is supported by a respondent from another EdTech company:

> 'But [*if*] we don't engage with teachers, and they are not on board for this journey, it's going to fail. And likewise, we can have one teacher that is very keen on the technology, but they're not the one that actually signs off the cheques. So you really need to work with every single one of those [*stakeholders*].' (Participant 2, CEO, 2020-09-09)

This comment argues that teacher endorsement does not provide the full picture – that is, you still need to consider the other stakeholders who are linked to the actual payment for the product. Having a product that is mature enough that it can be offered as a freemium option (where content is provided freely and additional services are charged for) does help to get teachers to 'test' the product ahead of financial commitments. Related to innovative ways to get teachers on board, another company introduced this interesting approach: 'We started looking at holistic development of support of teachers so things like financial education' (Participant 4, CEO, 2021-01-13). Offering

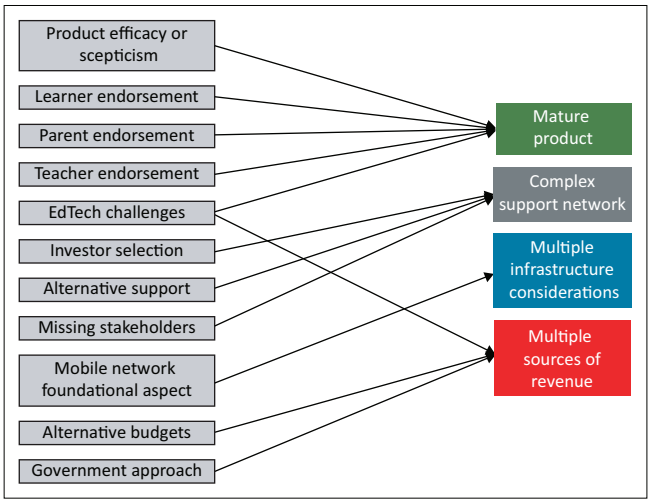

FIGURE 2: Thematic analysis outcome: Coded data relating to themes.

supplementary support services to the teachers helped to create a sense of community. Once again, this type of supporting function could only be delivered with a mature product.

Another respondent commented on product maturity being a key consideration to work with government:

> 'It's very difficult for a startup that's still trying to figure out exactly how everything works … to go to work with government because they're just going to throw scale at you. But if you've built things out, the value proposition is understood, and you're mature … they can bring you the scale that now allows you to enjoy the economies of scale, then it's a win-win everywhere.' (Participant 2, CEO, 2020-09-09)

This comment makes a clear reference to product, process and value proposition maturity, but perhaps also just the maturity of the company in working at scale. Another view on working with government – 'So we can't go do a 3-year study to prove the efficacy of our online offering, for example' (Participant 5, CEO, 2021-02-10) – referred to a barrier to entry.

Another company mentioned offering different 'packaged' versions of the product, which is only possible with a mature product. From a company that has been developing its product over many years, one respondent commented plainly: 'We need to build a much more mature product to engage with schools' (Participant 3, CEO, 2020-11-30).

Previous studies have suggested the following considerations, which correlate very well with this theme of a mature product when developing a business model for EdTech entrepreneurship:

- Innovation to develop a unique value proposition, based on 'radicality' that contributes to venture success (Taran et al. 2015) and on business model innovation (Chesbrough 2010; Dasilva et al. 2013; Geissdoerfer, Savaget & Evans 2017; Mansour & Barandas 2017; Tongur & Engwall 2014; Trimi & Berbegal-Mirabent 2012; Yang et al. 2017).
- Technology acceptance, including perceived usefulness, based on one of the main factors impacting the adoption of EdTech in a set of US public K-12 schools (Davis 2019).
- Open models to encourage collaboration with various stakeholders (Doganova & Eyquem-Renault 2009; Taran et al. 2015).
- Impact measurement (Joyce & Paquin 2016; Sanderse 2014).

The collaboration is, especially, true for working with teachers to build the mature product, and impact measurement is only possible with a mature product.

Theme 2: Complex support network

Questioning at the start of the interviews, which was intended to establish background, ended up providing very valuable insights into this theme for all the respondents. When asked about existing support structures, the first respondent commented:

> 'We have partnered with the "SocietyXYZ". And one of their members is one of the members on the board. And then in addition to that, we are also a part of the "FoundationXYZ" programme. And as a result, we get mentorship from them.' (Participant 1, CEO, 2020-08-31)

This response was encouraging, as there was an advisory type function on the company board, and there was a vehicle for mentorship via a foundation. When exploring support from investors, the respondent commented:

> 'There have been two major prerequisites for us. The first one is that the investor is investing in the company, not in their IP only. … The second one is that they in some or other way have some mentorship component, … being able to support us, taking us to the next level. For instance, pure cash injections are not really that enticing. It's got to come with those other two factors. And we walked away from a few offers over the years because of that.' (Participant 1, CEO, 2020-08-31)

Exploring whether finding an investor was something that the company still planned for the future, the response to not having an investor was: 'I would say it's an obstacle to growth' (Participant 1, CEO, 2020-08-31). It was clear that the respondent saw investment as a vehicle to scale more quickly, but only if the investor offered the necessary support structures, such as mentorship. This view was shared by at least two other respondents, who added that fit on culture and supporting the EdTech purpose was also important. One company did not get incubator support, but still managed to get the required investors on board, with a focus on strategic support to expand into the rest of Africa. An interesting comment on investors followed from another respondent: 'I don't think they're going to get very high returns in the sector … You need investors who've got a really long-term view on it' (Participant 3, CEO, 2020-11-30).

One respondent commented that they had been part of multiple incubation programmes. A respondent from another company went on to discuss their experience with getting support, commenting that, for the first few years, they had no success, until one support programme started opening doors, which led to key partnerships for this company. A third respondent mentioned that, even though they had not been part of a formal incubation programme, they had had support in their early days. The same respondent went on to comment on the impact of not having an advisory board support structure:

> 'And to this day our board is comprised only of the minimum number of representatives we have to have on the board from the shareholders. … we don't have an advisory board, we never have had one. … There are a couple of occasions where I think if we had an advisory board, we might have made some decisions differently.' (Participant 3, CEO, 2020-11-30)

Theme 3: Multiple infrastructure considerations

Investigating 'mobile network as foundational component', a more complex than anticipated view of 'multiple infrastructure considerations' emerged. One respondent

indicated the importance of mobile telecommunications networks, but also suggested that relationship-building with them was complex, and went on to suggest that EdTech companies could be seen as their competitors. The comment about being seen as competition was supported by another respondent. A third respondent indicated how the barrier to the mobile networks (referred to as 'telcos' in the quotation below) was breached when the COVID-19 pandemic hit:

> 'During COVID now there was such massive adoption of our tech, a lot of the telcos came to the party and we've been zero-rated by a number of them. So it's free to use our platform. So the telcos generally are being very supportive and sincere.' (Participant 2, CEO, 2020-09-09)

Another respondent supported the positive impact of the mobile networks, especially for poorer schools and learners:

> 'Whatever EdTech offering you've got over phones, mobile network infrastructure is more prevalent than any other kind of infrastructure at the moment, and the mobile networks play a really big role in delivery. And we've seen that [*with*] our zero ratings … We don't have an independent study, but we are utterly convinced that those have been instrumental in allowing us to get to the reach that we've got.' (Participant 3, CEO, 2020-11-30)

A respondent from another company, however, explained a very interesting constraint with zero rating, especially as it pertains to EdTech video content, commenting:

> 'And it's an interesting one, because [*of*] the cost basis. … The zero rating is quite a tricky thing, both from getting approval, but then also the actual IT infrastructure.' (Participant 5, CEO, 2021-02-10)

It turns out that, to get the zero rating, the EdTech company has to serve the content from its own servers, meaning that it incurs all the content distribution costs. This dilemma can go as far as having to reconsider the product content format – for example, a more mature product with multiple content formats – or having to consider alternative infrastructure components. This also depends on how much infrastructure is implemented by government and/or the schools; as one respondent commented, some provinces or schools '… buy their own hardware and infrastructure for the school' (Participant 3, CEO, 2020-11-30).

Another very interesting infrastructure consideration emerged about where the EdTech content is hosted. More than one company referred to their content being hosted by cloud providers, with one respondent commenting:

> 'From an infrastructure point of view we host our platform on "CloudPlatformXYZ". I don't think we would be able to have built our platform, and been able to build the infrastructure, … it would not be feasible. … But because of "CorporateXYZ" and their infrastructure cloud solutions, we've been able to build the solution, and it's built now for scale.' (Participant 4, CEO, 2021-01-14)

At least two respondents also indicated that they received discounted access to cloud services because of their registration as social enterprises in the EdTech space.

Theme 4: Multiple sources of revenue

This theme is critical to answering how 'value capture' provides input to making these ventures sustainable, while still fulfilling their social impact purpose. It very quickly became evident that a multitude of structures existed and were being used by these EdTech companies to survive, and even to grow. As one of the respondents said, most companies were only successful with the required social impact when considering multiple sources of revenue:

> 'Because you want to have impact, you cannot ignore the under-resourced part of South Africa. So you have to try [*to*] create a model that allows you to get through to those people, but at the same time, balancing the costs of doing so with some sources of revenue, whether that be grants or sponsorships of some sort. And then if you try [*to*] go the direct-to-customer route, you're going to find a relatively small market there. So, I'd say that, in a nutshell, the biggest challenge going into EdTech in South Africa is that you have to diversify your revenue streams.' (Participant 1, CEO, 2020-08-31)

In respect of government funding, the first respondent commented that the relationship with government was complex and was not something that was established overnight, and that the relationship in the overall eco-system would need to be quite mature before accessing government funds. This view was shared by another respondent, who commented: 'We've strategically decided not to focus on having government as a customer' (Participant 4, CEO, 2021-01-13), as they felt this was too complex a relationship. A third respondent from another company also commented on the challenges of getting revenue from government: 'It's not relationships, it's … we can't step through the bureaucracy layer yet, because we don't have enough critical mass' (Participant 5, CEO, 2021-02-10), but then added:

> 'I am hopeful that at some point government will be a customer of ours … because I do think that is one of the fastest ways to close the [*education*] divide.' (Participant 5, CEO, 2021-02-10)

For one of the respondents in a company that already had a solid relationship with government, the following comment suggests that it is still not that simple to get income from this entity: 'We've been unable to navigate procurement with any of the provinces so far, but we would like to' (Participant 3, CEO, 2020-11-30). From all of the companies interviewed, only one had been successful with generating revenue from government, based on a mature product. One other potential revenue stream from government that was mentioned was a social impact bond, which exists in South Africa for early childhood development, and might be an option to consider in the EdTech sector.

Some companies were surviving purely on grants, and in some cases on competition funding. One respondent commented: 'Where we have found funding is, yes, grant money. It is a big thing in education. And we have sourced funds through that route over the years' (Participant 1, CEO, 2020-08-31). A second respondent from another company

commented: '[*we*] focused largely on grant money, competition money ...' (Participant 4, CEO, 2021-01-14). A respondent from a third company commented on two possible business models to create alternative revenue streams – one from government and the other from private schools – indicating that, until these worked, they would rely on grant funding:

> 'Neither of those business models is yet working well enough that we could just double down on that. So we still have to do other projects with grant funders, and things like that, to keep going.' (Participant 3, CEO, 2020-11-30)

It was clear that at least three of the five companies interviewed were still relying quite heavily on grant funding.

When looking into corporate companies as a source of funding or revenue, there is the possibility of an EdTech company pivoting completely to this customer segment, as in this comment from one of the respondents: 'There's a lot more money in corporate. I know quite a few people that have pivoted into corporate training' (Participant 3, CEO, 2020-11-30). The same respondent went on to argue that once you get part of your revenue from corporates, 'It really distracts you … [*e.g.*] after about one year, generating 90% of your revenue from corporate training with a lot less effort, you would end up shutting down the schools business'. But at least two of the companies interviewed had created revenue streams from corporates without losing sight of their basic education social impact purpose. The first company generated income by operating a component of its business as a non-profit to gain access to corporate social investment, but was also investigating advertisement revenue by targeted advertisements on the EdTech platform, as well as building a marketplace for content delivery. The second company that was already generating revenue from corporates commented: 'To pay the bills we've actually served corporates, so we built learning management systems for corporates' (Participant 5, CEO, 2021-02-10). The same respondent elaborated on further plans for value exchange – that is, revenue and brand alignment for the EdTech company in exchange for corporate offering advertisements.

One of the respondents summarised well how multiple sources of revenue help to fund the high staff cost:

> 'I think, if you're playing in one market, you're very exposed … So for us, diversification means not only playing in South Africa; we need to look north, we need to look international, … but it also means diversifying your [*delivery*] competencies … Now your unit economics are even more powerful, because now what you're creating with that big expense line is now serving multiple channels.' (Participant 5, CEO, 2021-02-10)

Multiple sources of revenue not only provide the necessary income, but also minimise the risk of complete income loss.

Previous studies suggested the following possible considerations for multiple sources of revenue when developing a business model for EdTech entrepreneurship:

- Diverse funding sources (Gundry & Welsch 2001; Pretes 2002).
- Delivery to a broad customer base, based on 'reach' that contributes to venture success (Taran et al. 2015).
- Simple and focused revenue streams (Chikoto & Neely 2014; Eurich, Mettler & Stanoevska-Slabeva 2011).

The empirical findings from most cases reported funding from multiple sources, even if it was a similar type of funding – for example, getting grants from multiple entities. Simple and focused revenue streams could be misinterpreted as getting revenue from only one source; in fact, however – along with the broad customer base – it suggests that even if the revenue stream structure is simple, it makes sense to source revenue from multiple sources for the venture to be sustainable.

Additions to the value blocks

In the 'value creation' area, partnering with other EdTech entrepreneurs, as indicated in the original model, especially when the offerings were complementary, was supported by one respondent referring to it in these terms: '… because the landscape is quite sparse in South Africa. It's almost like finding a friend on a desert island' (Participant 1, CEO, 2020-08-31). Three new entities were identified for the value creation area: non-governmental organisations (NGOs), incubators or accelerators and academia. The NGO business model (Sanderse 2014) and, more specifically, how the EdTech entrepreneur should consider the 'not for profit' and social impact construct (Joyce & Paquin 2016) was considered. However, the NGOs were not added to the original model, as they provide grants as social impact funders, which is not necessarily associated with a sustainable business model. One of the respondents commented:

> 'NGOs play such a big part in education in the developing countries. They're quite a big funder of EdTech in certain areas where the need is high, but the addressable market is very small. And the NGOs do play quite a big role, especially the big organisations, UNICEF and things like that, in trying to advise and change government policy.' (Participant 2, CEO, 2020-09-09)

This response made it clear that NGOs should be added to the model, as they typically have an international mandate, and can be social impact funders and/or policy advisors. Other than the typical support from incubators and accelerators, one of the respondents commented: 'I think the highlight of it was access to networks', and even more interestingly: 'They specifically focus on entrepreneurship development, and so I met their founder, … and from there [*they are*] now a partner in our business' (Participant 5, CEO, 2021-02-10). So the incubator entity provided access to and created value networks.

When exploring the role of mobile networks, a broader set of infrastructure considerations came up, such as ICT connectivity and infrastructure projects (DBE 2019), which was listed as 'infrastructure' in the model, and included everything other than mobile networks – for example, fibre connectivity, cloud computing and computers in schools. Media outlets were added to the model, based on the

comment: 'Media outlets, radio, television, newspaper, magazines. They can have a very powerful effect on pushing the value of your EdTech products to people' (Participant 1, CEO, 2020-08-31). Aggregators were the third entity added to the 'value delivery' area of the model.

In the 'value capture' area of the model, after a discussion in more than one interview, it was clear that the actual learners or students should also be listed. The other two entities that were added were foundations and corporates. Foundations were originally also omitted from the model for reasons similar to those for not adding NGOs – that is, they typically provide grants. One respondent summarised very well why corporates should be in the model:

> '… the typical South African is not going to be able to afford a subscription service to get access to our platform. So, when I looked at who's going to pay for that access, corporate South Africa is where the money sits.' (Participant 4, CEO, 2021-01-13)

It was clear that at least one respondent was generating income from corporates. An even more interesting finding was a situation in which a corporate was providing incubator support in the value creation area, infrastructure in the value delivery area, and income – initially as a grant via the corporate foundation – in the value capture area. Another comment worth mentioning here relates to a corporate company that goes beyond just fiscal value: 'they're a strong, powerful professional brand, being married to that is very powerful for our brand' (Participant 5, CEO, 2021-02-10).

In summary, nine new entities were identified and added in black text to the value blocks (see Figure 3). One of the respondents indicated that the absence of such a stakeholder map was one of the biggest EdTech challenges in this environment:

> 'The big problem in education is that you're trying to produce this map of stakeholders. In other verticals it would just be less complicated. It is more complex, and more fragmented than most.' (Participant 2, CEO, 2020-09-09)

This challenge extends from just the high-level stakeholder map to what the stakeholder structures look like in each of the blocks and, even more specifically, who these people are in the South African ecosystem.

Discussion

The three propositions that were set in this study as they related to the themes identified from the data collection and analyses are summarised in Table 1. Although theme 2 can be related to all three propositions, it has the strongest correlation with proposition 2. The four themes were added to the framework in Figure 3.

Teachers have the greatest impact on value creation

The findings of theme 1 support proposition 1, with the qualifier being 'mature' product. Teachers do distrust the impact of the EdTech product unless it is mature, at which point there is a much higher likelihood that they would trust it, and even endorse and support it. At least four of the five case studies had a mature product or value proposition, and the fifth case was busy expanding the scope of the value proposition. The findings in theme 1 argued for the importance of the teacher's endorsement as being even greater than the endorsement from parents. Theme 1 also identified multiple strategies that EdTech companies use to get teacher endorsement, which includes offering a freemium version of the product for teachers to try out ahead of a commercial commitment, and creating a community in

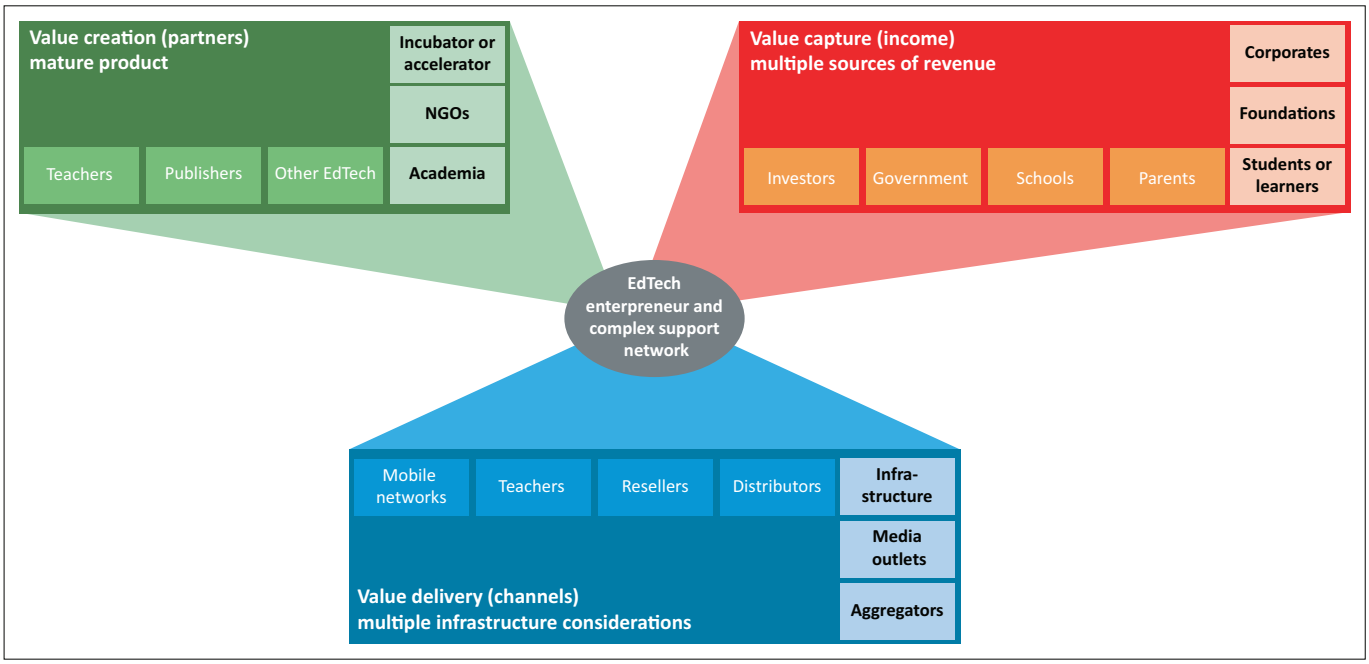

FIGURE 3: Business model framework for education technology in South Africa.

TABLE 1: Propositions related to themes.

Proposition	Theme
1 Teacher distrust has the greatest impact on value creation	1 Mature product
2 Investor scepticism and government revenue streams have the greatest impact on value capture	4 Multiple sources of revenue and 2 Complex support network
3 Mobile network zero rating has the greatest impact on value delivery	3 Multiple infrastructure considerations

which teachers can collaborate. Where the product is offered directly to learners or as an alternative to mainstream schooling, collaborating with teachers to create the product is still important.

It can be argued that teachers have the greatest impact on value creation; but it is worth also mentioning incubator and accelerator impact because they help to establish the relationships between all the stakeholders.

Government and corporate revenue streams have the greatest impact on value capture

Theme 2 identified multiple stakeholders in a complex support network, including investors. Most EdTech companies in this study were still largely funded by grants. Where the EdTech companies considered using investors to scale more rapidly, it was clear that support that extended beyond financial input was critical to the partnership, such as networks and experience to expand into the rest of Africa.

These findings support the first part of proposition 2 that investors are sceptical of a return on investment in the South African basic education EdTech sector. Only one of the five cases had successfully partnered with mainstream investors. The broader set of results from theme 2 addresses many of the other 'support' functions that exist in the EdTech value network, such as incubators, accelerators, foundations, company advisory boards, NGOs, academia and corporates. These other stakeholders offer alternatives to formal investment arrangements.

Proposition 2 also argued that government revenue streams have the greatest impact on value capture, with findings from all the cases confirming that government has a major influence. Even without a direct impact via a revenue stream, the influence is driven by curriculum control and product endorsement. Theme 4 identified multiple sources of revenue, driven by a mature product and complex support network. Most companies had more than one source of income, or were actively planning for additional sources of income. These included income from grants, investors, private users, top quintile schools, corporates and government. Only one of the five cases confirmed a revenue stream from government.

Foundations and corporates arguably have a greater impact on value capture than investors and government at the moment: at least three of the five cases depended on grants, and at least two cases were building revenue streams from corporates. Sourcing revenue from corporates does not mean that the EdTech venture needs to pivot completely to the corporates as a customer segment, but rather that an additional revenue stream from corporates can help to support the venture in delivering to the basic education customer segment.

Multiple infrastructure providers have the greatest impact on value delivery

Theme 3 identified multiple infrastructure considerations, which included mobile networks, specific constraints for serving video over zero-rated mobile networks, broader infrastructure initiatives by government and schools, and content-hosting options in the cloud.

The findings from theme 3 do not fully support proposition 3. Of the five cases investigated, only two relied strongly on content delivery over mobile networks. The other three cases mentioned challenges in engaging with the mobile networks, which included being seen as a competitor, but also having to navigate a complex infrastructure that puts constraints on serving video over zero-rated mobile networks. Even with these challenges, the EdTech companies were interested in expanding their offerings over mobile.

Mobile networks do have an impact, but perhaps not to the extent that they impact the economic sustainability of these ventures, other than perhaps cash-strapped companies that depend only on grants. This was true for only one of the five cases that were investigated. Another case that also relies on mobile network delivery does have other sources of income, making it less reliant on mobile network zero-rating.

The broader results from theme 3 do, however, point to other infrastructural considerations and related costs. For these EdTech ventures, their typical main cost is people; as one respondent commented: 'We're knowledge businesses, … your overheads are enormous because you put in people' (Participant 5, CEO, 2021-02-10); but the cost of infrastructure is not negligible, especially if not all of its parts have been discounted or zero-rated. At least two of the cases indicated that they had discounted cloud hosting costs.

Conclusion

In this study, a framework that identifies key considerations for sustainable EdTech entrepreneurship in South Africa was developed, and is presented in Figure 3. Four themes, along with a more comprehensive list of stakeholders, were identified and added to the framework. This framework, thus, provides a blueprint for existing and new EdTech ventures in an emerging economy to evaluate their business plans and models in the EdTech value network.

Providing a mature product as part of the value proposition opens up the rest of the opportunities in the value network. Getting to this point seems to be best achieved by starting with what you have, or being means-driven (Read et al. 2016) and partnering with teachers and other EdTech companies to enhance the value proposition with bootstrapping, competition or grant funding. One of the key relationships is with the South

African DBE, even if only to align with the curriculum or receive product endorsement.

Once the mature product is ready, which includes alignment with the country's curriculum and languages, multiple streams of revenue can be accessed via a complex support network. This support network includes negotiations with infrastructure providers to provide free or discounted access, as the EdTech offering for basic education has a major social impact that provides positive brand alignment. EdTech ventures should find the right support structures, which include finding incubator and accelerator support, as well as an advisory board. The EdTech ventures should actively search for multiple sources of revenue, including those from corporates and government, which come from building multiple meaningful relationships.

The government has recently reported on partnerships with the private sector as funding sources and providers of connectivity and infrastructure (DBE 2019). Government could consider extending and improving the partnerships with small to medium-sized EdTech companies in the private sector. This could be done through even more clear and updated policy guidelines, as well as consistent implementation at the provincial level, which includes a clear policy-to-budget-to-procurement alignment.

Another key partnership is between EdTech providers and corporates, which could extend to a partnership between these two parties and government. Corporates should continue to support EdTech companies with social impact grants, but ultimately only as a steppingstone to a more sustainable arrangement that includes value for the corporate in exchange for revenue streams to the EdTech companies.

An incubator support system has significant value: apart from building a business plan and getting mentorship on how best to pitch to investors, it could provide access to a broader set of stakeholders in the value network. Some of the key relationships that could be built on the back of this incubator support are long-term coaching and mentorship arrangements, access to infrastructure providers and access to funding. It is promising to see support systems such as Injini in South Africa focused on EdTech in Africa. Incubator and accelerator support functions should support EdTech ventures, even if they do not exactly fit the entry profile into their programmes.

Building a sustainable EdTech venture in an emerging economy is a major challenge, as one of the EdTech companies responded during the interviews:

> 'Some of the challenges that we have with poverty or financial inclusion are the same challenges we have for EdTech; they're not education problems really, they are societal problems and human problems. … It's not about how do we transform an industry, it's how do we transform a society; and those are really big things.' (Participant 2, CEO, 2020-09-09)

We have a major societal challenge, and education can make a difference. With better support, more EdTech companies would become sustainable, and so would help to improve the quality of education in South Africa.

Study's limitations

This research was limited mainly by the number of cases that could be covered. The cases represented a good sample of the target population, but there were still only five of them. The case study method by its very nature does not provide for generalisation to the population. The COVID-19 pandemic created additional challenges for this study, as businesses were trying to survive or ramp up rapidly to meet the demands of e-learning. This put additional pressure on the EdTech companies, which meant that it was even harder to get input from them.

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Authors' contributions

Both the authors contributed to the development and writing of the article. A.V.M. conducted the research as part of his Masters dissertation under the supervision of E.V.D.L.

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Data availability

Raw data were generated at the University of Pretoria. Derived data supporting the findings of this study are available from the corresponding author, E.V.D.L., on request.

Disclaimer

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