Education Technology (EdTech) innovations in ESSPIN

Introduction

Education Technology (EdTech) services and products have flourished over the last century and can now be found in varying forms in many education institutions, programmes and classrooms across the globe. In low-income settings, EdTech can provide access to quality learning content for children, ongoing professional development at a distance for teachers and improved data management processes for schools and governments, amongst others. Mobile phones, solar power, radio, e-readers and tablets have been acclaimed as enablers in these environments. However, a low-income setting is not homogenous and in a country as diverse as Nigeria, each State, school and community will face its own challenges implementing EdTech; including limited technical know-how, poor or obsolete internet connectivity, and unreliable electricity supply. These barriers are difficult for an education programme to address and change and thus for the main part, EdTech services and products need to innovate within the existing constraints.

With many interesting EdTech services and products on offer, the critical question for an education programme is whether they are improving learning and whether they can improve teaching and learning at scale in a complex setting, like Nigeria. There still remains limited evidence evaluating models and providing answers to the question thus ESSPIN sought to pilot a variety of EdTech initiatives and gather evidence of their impact in the context of Nigeria.

This paper describes the challenges ESSPIN encountered when piloting EdTech innovations and the lessons learned about the factors that contribute to enabling or disabling success.

EdTech models

This section reviews five EdTech models that were trialled and tested within ESSPIN.

1. Worldreader
2. Learn English Audio Pilot in Nigeria (LEAPIN)
3. Nigeria School Attendance Monitoring System (NSAMS)
4. Gbagan Gbagan
5. LGEA Education Management database
6. Geographic Information System (GIS)

Word Reader

Education topic	Digital Literacy
What problem does it address?	1. Low literacy levels amongst teachers and pupils 2. Schools have inadequate resources, in particular insufficient textbooks and supplementary readers.
EdTech innovation	e-readers loaded with relevant reading materials
Technology partner	Worldreader
Scale	Pilot: 3,200 P1-P4 pupils across 20 schools in Lagos and Kaduna
Impact	Baseline and end-line evaluation completed January 2017. Progress Report ESSPIN E-reading Pilot Project, September 2016, Worldreader.

In November 2015, ESSPIN partnered with Worldreader to deploy 1050 e-readers loaded with 140 relevant and grade appropriate reading materials to schools in two ESSPIN states; Lagos and Kaduna. The pilot project is still ongoing and works with 10 schools in each state and 3200 pupils from P1- P4. The goal of the pilot project is to demonstrate that the inclusion of quality reading materials in complement with already existing and improved pedagogical skills of teachers will help accelerate learning and result in increased pupils' reading fluency and comprehension as well as positive changes in attitudes and practices around reading. The mid-term progress report and end-term evaluation both provided observations on successes and challenges to date.

What is working well?

The innovation is making headway creating **positive attitudes towards reading**. In the mid-term progress review, '60% of pupils interviewed loved the e-reader because it had so many books' on it while '57% reported loving it because they enjoyed the books on it' (some students selected both reasons). By the endline, 67% of pupils asked said there was nothing they disliked about the e-reader. Although they were attracted by the technology, there is also a clear shift to talking about the books on the e-readers. One teacher in Lagos said, "They have a passion for reading now because of the e-reader." [1] Another said: "I can see that those who didn't have interest in reading before are now picking up."[2]

In an environment where users have limited or no technical know-how, it is essential that the EdTech device is **easy to operate and maintain**. By the mid-term review, all 29 pupils interviewed in Lagos and Kaduna could operate the device and had read at least one book on the e-reader. Over the duration of the pilot, only one device had broken. This can be attributed to effective training on device maintenance, coupled with the very sturdy charging stations and storage containers provided by ESSPIN.

[1] Worldreader. Final Progress Report ESSPIN E-reading Pilot Project. September 2016.
[2] Worldreader. ESSPIN e-reader Pilot Programme Final Evaluation Lagos.

Efforts were made to give ownership to schools, local government and SUBEB and **embed in the existing school improvement system**. SUBEB School Services Department lead the planning and implementation of the project through the SSIT members, SSOs and the communities in which the schools were domiciled. A number of SUBEB officials and a few community members were trained along with the teachers and head teachers. Some technology savvy teachers were given additional training to serve as 'Project Managers' in their various schools to deal with technical issues and issues around integration of the devices into the curriculum. Thus this project was being directed, managed and monitored by education officials (SUBEB and LGEAs) within the system. Schools were tasked to develop effective schedules and policies that allowed for e-readers and e-books to be maximized both in and out of instructional hours, ensuring the innovation was institutionalised within the school. School Support Officers (SSOs), SSITs and ESSPIN staff, who already conduct school visits, were trained to be able to provide ongoing support to schools and monitor progress consistently in line with their existing roles within the system. This attributed to the high levels of usage and competence with the e-reader.

What are the challenges?

Limited child-centred teaching. Whilst all teachers and pupils were able to use the device, the extent to which they used it seamlessly in lessons and in a child-centred way varied greatly. For the main part in Kaduna, where users were less exposed to technology, the teachers used the e-reader as a textbook reading from it with children responding in chorus. This demonstrated that ongoing training and support are needed to help teachers build confidence and skills to use the e-reader to its full potential and apply their previous learning on child-centred methodologies with this device. It shouldn't be underestimated the extent to which this is new learning for teachers and they need ongoing support to deliver quality lessons with a new teaching tool.

Limited pupil ownership. Observations also found that pupils were not exposed to the full variety of readers available on the e-reader. There were limited cases where pupils were given the freedom to explore the device independently. Whilst pupil-led, exploratory learning was reinforced in the training, it goes against the grain of familiar teaching styles and thus requires time and continuous support to reinforce. This support should be built into any EdTech programme.

Disabling classroom environment. Evidence clearly showed that in overcrowded classrooms, reading was less practiced, pupils were less confident with the device and group reading activities were absent. Interestingly, whilst EdTech initiatives often acclaim to promote independent and group learning, the reality is that this remains difficult in overcrowded classrooms, perhaps due to insufficient devices or uncomfortable learning conditions, therefore the context of these learning environments should be analysed carefully by EdTech innovators. The end-line evaluation recommended that the pupil to e-reader sharing ratio should be no more than 4:1.

What are the lessons learned and recommendations?

Involve schools in the content creation. Worldreader worked with ESSPIN to curate a standard booklist of 70 international story books and 70 African titles including locally published textbooks. In the future, schools, including children, teachers, parents and Head teachers should have the opportunity to select some of the books. This is important to ensure the books are culturally relevant and suitable to pupils' ability levels in school (which may not match the grade level) and in continuing to build more ownership over the innovation.

Provide ongoing support to help teachers to master the device and use it to its full potential in a child-centred way. The value of the e-reader, as with many EdTech tools is the ability to provide high quality, child-centred learning. As described above, this requires significant ongoing training and support for teachers to master.

Ownership amongst school and government stakeholders. Whilst the pilot is working well with ESSPIN and Worldreader support, the sustainability of such an innovation depends upon the school and government driving it forward. Schools need to take ownership of the innovation and plan their own sustainability, considering how they will train new teachers, repeat training year on year and if necessary raise funds to expand the model. Similarly, there is a role for government to play overseeing, monitoring and directing the intervention, ensuring government support staff and systems are in place for the schools. The progress report noted that a sustainable approach would benefit from a lead contact in position within SUBEB to coordinate all activities and liaise with Worldreader.

Include long-term evaluations to measure progress. The end-line evaluation included an Early Grade Reading Assessment (EGRA) however results did not show gains in reading fluency and comprehension. One reason suggested for this is that the skills gained were too foundational (improvements in reading single words rather than a full paragraph) thus recommendation from the end-line is that a longer observation period would be needed and would likely show improvement. The length of pilot and time needed to demonstrate gains in learning should be considered by future EdTech programmes.

Learn English Audio Pilot in Nigeria (LEAPIN)

Education topic	Digital Literacy
What problem does it address?	Poor English literacy levels amongst teachers and pupils
EdTech innovation	Energy efficient radios stored with audio English language learning materials aligned to ESSPIN Lesson Plans and National Curriculum.
Technology partner	British Council & Lifeline Energy
Scale	PILOT: 600 English teachers across 571 public primary schools in two states (Kwara and Jigawa)
Impact	Monitoring and Evaluation Report LEAP Project Nigeria. October 2014. The Open University. "The contents are suitable aids to assist with teaching and the pupils are very eager to listen and it makes lessons very interesting". Teacher, Kwara State.

Between September 2013 and July 2014 ESSPIN partnered with British Council to pilot the Learn English Audio Project in Nigeria (LEAPIN). The project provided teachers with audio language materials pre-recorded on a radio device named LifePlayer. Lifeplayer is designed to function well in low-resource settings without electricity as it is either self-powered solar or wind-up radio with speakers, media player and recorder. It includes an SD card pre-loaded with songs, stories, and poems aligned to ESSPIN lesson plans, which in turn are aligned to the Nigerian national curriculum. 600 teachers across 571 schools in Jigawa and Kwara received the EdTech intervention which included the device, content and training.

At the end of the pilot an external monitoring and evaluation report was produced by the Open University. The evidence showed that:

- 75% of teachers in Kwara and 65% of teachers in Jigawa were observed to be confident in using the device. When self-assessed, 10% more in each group self-declared to be confident.
- More than 90% of teachers acknowledged that the LifePlayer audio resources were useful for their lessons and that they liked them
- "Some of the topics in the lesson plans were difficult for me before but with the arrival of the life player, I find them easy" - Teacher.
- "Before now pupils had no understanding of pronunciation of rules, but now it has improved" - Headteacher.

Deleted:

What worked well?

Teachers reported that they felt more motivated by being part of the project. In this instance the technology device was engaging for both pupils and teachers. Amongst teachers it generated enthusiasm to develop professionally and deliver higher quality lessons.

A key success of the project is the reliability of the device – it was easy to use, maintain and power. It was specifically designed to fit the environment that the schools were in and could operate without need for electricity. Teachers reported that it was easy to use and there were minimum cases of malfunction (11 in Kwara and 16 in Jigawa). The fact that teachers continue to use them today shows they are easily adopted by the teachers.

Another success factor was that the project was embedded in the existing Nigerian education system and ESSPIN services. For example, the digital content was aligned exactly with the lesson plans provided by ESSPIN, which in turn were aligned with the national curriculum. The device provided audio versions of the songs, poems, stories in the ESSPIN lesson plans. Thus teachers knew where and how to integrate it seamlessly into their daily teaching. In addition, the training was delivered to teachers in line with their existing professional development system. School Support Officers (SSOs) provided ongoing support to schools and teachers thus were able to address any technical difficulties with the device and encourage teachers to use the devices. This resulted in the high user rates and positive attitudes towards the devices.

What were the challenges?

Whilst teachers were using the device effectively within the lesson plan structure, the evaluation report shows teachers were less able to take initiative and use the LifePlayer creatively in new ways. For example, few teachers used the recording function to record themselves or the pupils and play back for all to listen to. Thus teachers were not getting the full learning potential from the EdTech device. This demonstrates that whilst sufficient training was given to enable teachers to use the device, follow up training and support should be built in for mastery and enabling teachers to feel confident to manipulate the EdTech device and use it to its full potential in their own lessons.

Getting the digital content right is essential, especially in a country as diverse as Nigeria. In most cases teachers felt that the materials were suitable for their context and their pupils. In some cases, teachers felt the materials were too advanced for their pupils and/or were stories that were not culturally suitable to their environment. For 12 teachers this was the reason that prevented them from using the EdTech device. This highlights the importance of involving schools in the design phase and ensuring they contribute to the digital content.

What are the lessons learned and recommendations?

In this case EdTech enabled teachers and pupils to access audio that would otherwise be inaccessible. The ability to hear pronunciation of words was critical learning opportunity for both teachers and pupils.

A simple EdTech device that can be used without internet connectivity or electricity is successful in Nigeria. Teachers are able to use it independently after the project implementers have gone and it can be easily maintained using local resources. Whilst a simple observation, this was indeed key to getting teachers buy-in and motivation to use the device regularly.

A robust framework guiding teachers on how and when to use the EdTech device is useful. Having the LifePlayer audio clips prescribed in the lesson plans, which the teachers were familiar with meant they could easily adapt to this new technology and apply it with confidence in their lessons. The struggle arose over using the device innovatively. Teachers require ongoing training, support, observation and feedback to enable them to build the skills and confidence to manipulate the EdTech device in this way. This is important because it is at this level that teachers are able to use the device for high quality child-centred teaching and learning.

Whilst the evaluation report of this pilot was positive and observations show that many teachers continued to use the LifePlayers in their lessons after the project has ended, the intervention has not been scaled up or replicated to date. The key reason for this is lack of funds. The pilot required additional funding from partners to enable scale up. This demonstrates the importance of advocacy from the outset; engaging stakeholders such as funders or government with evidence of what is working can help get their buy-in to lead scale up.

Nigeria School Attendance Monitoring System (NSAMS)

Education topic	Education Management Information System
What problem does it address?	Poor availability and monitoring of attendance data
EdTech innovation	Recording school attendance data using mobile phones and website providing stakeholders at all levels with near-immediate access to attendance data and trends
Technology partner	Charlie Goldsmith Associates
Scale	Pilot: 164 schools, 1639 teachers across two states (Lagos and Kaduna)
Impact	Nigeria School Attendance Monitoring System (NSAMS): End of Pilot Report. August 2015. Charlie Goldsmith Associates.

The School Attendance Monitoring System (SAMS) allows teachers to report enrolment and attendance of pupils by sending a simple SMS to a server. It offers near-real-time monitoring of pupil attendance, at individual or at aggregate level, and can also be used to monitor teachers' attendance. Data is collected on a public website (which can be made private with passwords) and provides relevant stakeholders, e.g. school management, government or community with fast, visual representation of attendance trends. SAMS has previously been implemented by Charlie Goldsmith Associates (CGA) in South Sudan and Rwanda and in 2015 CGA partnered with ESSPIN to pilot a

similar model in Nigeria. The pilot took place in Kaduna and Lagos with 164 schools (1639 class teachers) over a period of three months.

The overarching objective of the NSAMS pilot was to ascertain whether Nigeria is ready for a technological innovation such as SAMS and to see if there was buy-in from relevant stakeholders. At the end of the pilot a report was completed by CGA which considered what had worked well and made recommendations.

What worked well?

The model used devices that teachers already owned and were familiar with (mobile phones, which teachers were assumed to own and know how to operate following a recent shift to e-payments for teachers' salaries). The technical requirement on the teacher's part was to send one sms to register and daily sms to report attendance numbers. This was deemed appropriate to teacher's skills and supported by the fact that teachers reported that it took around one minute to complete. This resulted in good reporting rates with between 1250 and 1500 daily reports being received (out of a possible 1639).

Existing systems and personnel were relied upon to monitor and support teachers. To check the accuracy of data, attendance was verified by SSOs on their regular visits to schools, they also offered support. Cascade training within the existing system worked well, when interviewed, teachers reported that they were able to quickly pick up how to use the device and process from colleagues.

In the End of Pilot Report LGEA staff reported that they were checking the website on a near-daily basis and following up on schools who were not reporting. State Education Secretaries were very pleased with how quickly they were now able to access information relating to their schools, where before it had taken a week and required conducting physical visits. They now had attendance data and trends at their fingertips and could easily identify potential attendance problems.

Stakeholders at both LGEA and school level reported that this system improved accountability. One Education Secretary stated that teachers feel a sense of ownership and accountability over the system, with teachers making sure they report accurate data as they understand that LGEA staff are able to cross-check with paper attendance records. Similarly, a teacher reported: "the system put us on our toes for taking accurate attendance at the right time". (End of Pilot Report)

Schools visited in all three LGEAs reported that NSAMS had improved the timeliness of both teachers and pupils, with pupils wanting to be included in the message sent to NSAMS.

What were the challenges?

The technical know-how of many teachers was extremely limited, to the extent that they didn't all know how to use sms and several mistakes were made when registering. E.g. they confused some numbers and letters such as 0 and O. (Although after registration they could competently use sms). This highlights the importance of using extremely simple technology that can be used independently by users with no previous experience or knowledge.

NSAMS relied upon working within this system, yet when the system didn't work (teachers didn't have registered civil service numbers, schools don't open on time, paper attendance registers were not completed, LGEA staff were not present) it caused problems for the innovation. This creates a tension because in the interest of sustainability it is desirable to work within the system but the

system will have gaps and errors that create barriers for the innovation. Thorough risk analysis and preparation can help mitigate this.

A key challenge in this pilot was the Mobile Network Operators, which proved unreliable and expensive. Preference was for NSAMS to liaise directly with Mobile Network Operators (MNOs) and pre-purchase SMS bundles that are then free at the point of use. However, a licence was required for this that was both costly and time consuming for the pilot project. The pilot missed out on early engagement with service providers and preparing groundwork for a mutually beneficial partnership. This is deemed essential in EdTech programmes as they naturally span two different sectors that may not be familiar with working together and thus a mutually beneficial partnership may take time to carve out.

What were the lessons learned?

This pilot was not taken to scale, largely due to the expense of the mobile phone operator. Whilst the technology was relatively easy to use and stakeholders reported that it did indeed improve attendance data collection and opportunities for monitoring in real time. The pilot did not prove feasible for scale up at this point in time in the Nigeria context, due to the high costs. This shows that greater work needs to be done to build partnership between development programmes and Mobile Network Operators in Nigeria.

Gbagan Gbagan

Education topic	Community Advocacy on school improvement
What problem does it address?	Poor communication at community level on school improvement
EdTech innovation	Deliver behaviour change messages around school improvement to key stakeholders in the community and bring stakeholders into dialogue on school improvement.
Technology partner	Flint Productions
Scale	Four series aired between 2010 and 2012 reaching approximately 10.5 million listeners.
Impact	ESSPIN Communications Impact Study ESSPIN Report 531 - Communication Impact Study at Resources/ Reports at www.esspin.org

As part of ESSPIN communications strategy, ESSPIN has developed and produced several communication products targeted at the general public to inform, sensitize and mobilize them for improvement in the provision of basic education in Nigeria. Radio has been successful with by far the largest and most widespread audience and increasingly reaching the most disadvantaged and excluded. For a remote population with low levels of literacy and a largely non-reading culture, radio is a successful platform to inform and entertain.

Gbagan Gbagan, named after the noise the school bell makes, was a radio drama with relatable like characters and storylines infused with messages on school improvement. Different elements of the

school improvement programme were emphasised each series. It particularly encouraged community engagement at the immediate school level and also raised broader governance and education quality issues. The radio show was aired weekly nationwide on state radio with repeats on national radio in English and local languages. Its purpose was to deliver behaviour change messages around school improvement to key stakeholders in the community and bring stakeholders into dialogue on school improvement. Between 2010 and 2012 four series were aired reaching approximately 10.5 million listeners.

What worked well?

ESSPIN's impact evaluation found that vital school improvement messages were reaching a wide and diverse audience, within and beyond ESSPIN states. In particular 53% of the audience picked up the message on sending all children to school and 35% picked up the message promoting greater community involvement in education.

The format and content was well suited to and enjoyed by the audience. In the impact evaluation almost all the respondents (95%) said they would like to listen to the radio drama "Gbagan Gbagan" in the future. They praised the show for being entertaining, easy to understand and having important messages for the community about education. One respondent noted: "*What I like is it very educating and easy to understand anytime you listen to it... It talks on children education to parents who are still resisting sending their kid to school. And I strongly believe that this programme can soften that mind and understanding about western education. Also make the teachers more serious".*

What were the challenges?

Whilst the listeners gave positive responses and felt the content was informative and entertaining. The response of one government stakeholder demonstrates his desire to be included in content creation. *"Well, the peculiarity of problems of a given community may perhaps, not be properly captured and this can only be addressed if the organizers will be liaising with the Board so that proper guidance … we know our problems…"* The radio show was purposefully designed to be independent however this highlights the importance of the role of government in education and exemplifies the need to ensure content is culturally sensitive and appropriate to the diverse range of listeners.

A second challenge to note, is that whilst radios are commonly owned and used, even in more remote and disadvantaged households, power outages can limit the use. For this reason, many respondents requested a CD of the radio programme. In this case ESSPIN did not provide CDs but supplemented the show with repeats aired at different times and other communication channels such as community theatre.

Perhaps the greatest challenge, and the reason for the termination of the radio show, was the increasing broadcast fees being charged on top of ESSPIN's investment in high quality material, which was delivered free to the broadcasters. With a large number of viewers at prime time, Gbagan Gbagan became lucrative for advertising. Advertising was seen as a sustainable exit strategy by ESSPIN as it would have ensured the radio show continued and was profitable for the broadcaster. However, this model was not favoured by the broadcasters, who demanded fees that no longer offered value for money for ESSPIN.

Lessons learned and recommendations

Education topic	Education Management Information Systems
What problem does it address?	Weak evidence-based sector performance monitoring, planning and management processes
EdTech innovation	LGEA Education Management Database
Technology partner	Uses Microsoft Access and Microsoft SQL server express (free software)
Scale	Following the success of the pilot in 5 LGEAs of Kwara State in 2013, all six ESSPIN focus states requested and signed up for rollout of the initiative beginning with 4 LGEAs in each of the states. Two non-ESSPIN states are also rolling out the initiative.
Impact	Beneficiary feedback: "The LGEA Education database is an indispensable databank that helped the state to decongest the State EMIS in terms of data needs for development planning both at the state and local levels". - Head of EMIS, Enugu state Ministry of Education.

Throughout ESSPINs communication strategy, radio proved an effective tool over TV and print material for engaging community. It was successful in reaching the most marginalised communities and engaging them in key messages on school improvement.

Broadcast fees were a disabling factor for Gbagan Gbagan. An alternative approach would be to work with radio companies to reduce or remove broadcast fees however this requires significant capacity building, and advocacy across the media industry, something ESSPIN did not have the resources to do. The key to the relationship is to work in partnership rather than to use the media simply as service providers and this should be considered and executed as thoroughly as possible in future EdTech innovations.

LGEA Education Management Database

The ESSPIN-supported LGEA Education Management Database is an EdTech initiative designed to support capacity development for integrated bottom-up education sector monitoring and reporting. The digital database is for the collection, storage, analysis and dissemination of data and information on pupils, staff, facilities, teaching learning processes and community participation at school level, collated at LGEA level and integrated into State Education Management Information System (EMIS). For the first time this data is now collected on one electronic database available at State level. Workstations are set up where users can interact both with the software (using the front-end) and a server (back-end) where the actual database is residing. The open source software is easy to use and cost-effective. The front-end is using Microsoft Access, part of Microsoft Office. As all offices are already using Microsoft Office no additional expenses are incurred.

More specifically, the LGEA Education Management Database is being used for the following:

Schools	All school records, including coordinates. Schools can be displayed in Google earth with a click of a button.
Staff records	All staff details, including staff qualification, the classes and subjects being taught by teachers, records of service.
Reporting	Quarterly reports on School and Teacher development, Social Mobilisation and Quality assurance are input into the database for easy access and compilation of summary reports
Attendance data	Attendance information on pupils and teachers, collected at schools on a weekly basis.
School Improvement	Improvements from building new structures to supplying textbooks can be entered used for progress monitoring and planning
In-service training	On the job training for government and non-government staff can be recorded
Annual School Census data (ASC)	Data collected during Annual School Census can be easily imported into the database for easy access.
Integrated School Development (ISD)	ISD gives information on *Adequacy of Physical Facilities*, *Adequacy of Staffing* and *Institutional development*. ISD data can be imported into the LGEA Education Management database making this information easily accessible.

What is working well?

Prior to this intervention, much of the data gathering and recording was completed by hand, filled out on paper and stored in hard copy files. The digital database improves upon this process by ensuring timely availability of data and evidence for quality, planning, budgeting, management and policy development. Information can be made available at different levels and to a variety of stakeholders. This increases accountability and transparency and improves decision making at all levels. For example, each LGEA has its own database, whilst previously reports were submitted to the State and effectively signed off and forgotten, data and evidence is now used at LGEA level as well. This raises the technical capacity of EMIS teams at LGEA level and enhances quality of reporting and data collected.

Decentralising EMIS data collection and management also has the benefit of speeding up the process and reducing costs. Each location has its own database. A key advantage is that there is no need for an Internet connection. Data is exchanged by means of export/import. This can be exchanged by email, flash drive or other media

What are the challenges?

Government offices were not equipped for digital systems. In all instances the LGEA provided the required hard ware, however more often than not, although meeting the requirements, the systems were old and not well maintained. Similarly, electricity supply and local area networks in LGEAs, when existing were often unreliable, leading to system unavailability.

Alongside poor technological equipment, technical capability amongst government officers and management was poor. Whilst they were able to grasp the concept and understand the process, it took significant training to ensure they could manipulate and interact with the database. This created challenges and slow start-up, yet it also propelled a change in culture with technological

capacity of government officers improving and more offices are becoming equipped with hardware and internet.

Education topic	Education Management Information Systems
What problem does it address?	Poor evidence-based sector performance monitoring, planning and management
EdTech innovation	Geographic Information System (GIS) used to map school location and data
Technology partner	EDOREN
Scale	All schools in ESSPIN, GEP3, TDP, DEEPEN

What are the lessons learned?

This is a good example of an initiative that is not built around technology, moreover it addresses something that was broken in the system – poor data collection, use and reporting– and creates an intervention to improve it with technology as the enabler. In this instance State governments are buying into the initiative because it improves their Education Management Information System. The use of technology is affordable and speeds up the process, whilst ensuring data is reliable and visible to stakeholders at all levels of the education system.

Geographic Information System (GIS)

The school coordinates (or Geographic Information Systems, GIS) of a large number of the schools in the ESSPIN partner States was derived from a data set collected as part of the Federal Governments MDG Programme. This provided ESSPIN with valuable school mapping data without going to the field which would have been a very costly exercise. This data was then converted to overlay files that could be used with Google Maps and Google Earth. By adding attributes to the data from the Annual School Census data or ESSPIN's ISD school scores (a score of 1-100 on the school's ability to deliver quality education) map pins can be colour coded or reshaped to display schools on a map by some characteristics. For example, the distribution of schools with no electricity, no water and both no water and electricity or poor, average and good schools distribution.

What is working well?

The application of GIS in school mapping provides a user-friendly method to improve allocation of resources and efficiency in the delivery of services. The States were eager to get this data and the feedback from the six Education Commissioners was extremely positive. The States seem keen to complete the missing schools and use the data provided to improve school lists but this will be post ESSPIN. The Jigawa Commissioner has already approved this work in her State. EDOREN is using the data going forward in support of various surveys and research work and the data has become part of the legacy of ESSPIN. Some states had budgeted for data gathering so the ESSPIN gift has reduced the costs considerably.

What are the challenges?

There is a degree of computer data skills to create maps showing various criteria and there was not the time or resources left in ESSPIN to support the States capacity to do this. This means the States will not be in a position to fully exploit the useful data they have. However, there is opportunity to partner with local technology innovators, some of whom are already building school info applications.

What are the lessons learned?

The visual representation of school data is simple to use and aids effective planning in education. For this reason, it has been widely adopted across Nigeria. In future programmes this data should be collected as part of a baseline which will assist considerably in the running of school intervention and data collection activities. Also it is evident that States would benefit from having this data with some effort being made to build the applications for effective use and planning.

Additional EdTech innovations

In addition to the examples above, ESSPIN has integrated technology into a variety of its approaches and built capacity of staff and education stakeholders to use technology. In the 2016 Beneficiary Assessment 76% of beneficiaries asked said they now felt confident using a computer for their work and 99% agreed or strongly agreed that 'using a computer has made my work easier'.

Additional EdTech innovations trialled by ESSPIN but without impact studies include Lesson Plan Videos, WhatsApp groups, Computer Aided Personal Interview, Integrated School Database and UIS Software.

Lesson Plan Videos were created to support and train teachers across Nigeria to use the ESSPIN Lesson Plans. Teachers in local schools were filmed demonstrating best practice using the Lesson Plans, integrated with tips and training advice to help users get the most from their lesson plans in the challenging environments in which they work. Videos were uploaded on DVD and distributed to every ESSPIN school. The Lesson Plan books were also made available in digital copy on ESSPIN website and have since been adopted for interactive digital versions by DFID funded Teacher Development Programme in Nigeria.

Whatsapp groups emerged as an effective EdTech tool for evidencing best practice and monitoring activities in schools. School Support Officers set up their own Whatsapp groups to share photographs and messages on their school visits. This creates an online depository of best practice and observations of school improvement. Furthermore, the shared, real-time digital space encouraged comparison across schools and healthy competition to promote best practice and share the evidence and celebrate the successes.

In partnership with OPM, **Computer Assisted Personal Interview (CAPI)** is used to conduct interviews with stakeholders and gather evidence for impact studies. For example, Composite Surveys 2 and 3 use CAPI to select sample participants from over 6 million ESSPIN beneficiaries across 6 States. This proves cost-effective for large scale surveys. CAPI ensures fair testing with advantages such as applying logic to questioning so that previous answers can determine the next question asked or appropriate level of difficulty in a test question.

ESSPIN introduced digital data collection and analysis in the **Annual School Census using UIS software.** The software improves speed and accuracy in data collection. One beneficiary, the Director of Planning Research and Statistics, Enugu State Ministry of Education noted: "*ESSPIN brought new innovations, and told us we could use Microsoft Excel to input the data and this simplified things. They trained our staff to use the software to input and analyse data. The 2009 ASC was the most accurate of all education census conducted years before".* UIS software for Annual School Census is now used across all 36 states to compile key data on schools.

Through the **Integrated School Development (ISD**) model ESSPIN developed a means of allocating resources based on the needs identified through analysis of Annual School Census (ASC) data. This allows states to target resources in a much more systematic way than before. It not only demonstrates the value of data capture and management for practical planning purposes, it is providing a means of determining resource allocation so that spending is more coherent and related to needs. Integrated School Database (ISD) draws school level data from the Annual School Census and is used to select schools and drive school improvement.

The radio call-in programme **Eko Lagba** was developed by ESSPIN as a community advocacy tool in Lagos. It was broadcast in local language, Yoruba, on Bond FM to enlighten people on gains of the reforms in Lagos. It was a 13-episode programme. School Improvement Programme actors were invited every Thursday to speak on positive changes recorded in Lagos. Many callers engaged with the invited guests through series of questions to clarify School Improvement Programme activities. One of the gains was the influx of pupils from private schools into the government schools.

Conclusion

Nigeria is a diverse country with pockets of extreme poverty, conflict, nomadic lifestyles, urban slums as well as highly developed regions. This provides an interesting ground to test and compare EdTech innovations. The pilots in ESSPIN show that there is appetite for technology in education across Nigeria but that it requires careful consideration to plan and implement.

Using the analysis of five ESSPIN EdTech innovations, we identify the following components for success:

- **Build multi-sector partnerships**
  Greater work needs to be done to build mutually beneficial partnerships between technology providers and education development programmes. In some cases, this requires significant capacity building and advocacy across the technology service providers' industry. The key to the relationship is to work in partnership rather than to use the technology providers (e.g. mobile phone networks, broadcasters) simply as service providers.

- **Provide ongoing training, observation and feedback for users**
  Mastery of an EdTech tool should not be underestimated. Whilst initial training can enable stakeholders to use the tool, the true educational value comes in being able to manipulate the tool and in cases of teaching and learning, use it in a child-centred way. For many teachers in developing countries, this requires a complete shift in teaching style. Learner-centred pedagogy and discovery learning relies heavily on group work, discussion and pupils investigating the concepts rather than being instructed by a teacher. The teacher's role therefore changes to a facilitator of learning. This necessitates professional development comprising of ongoing training and follow up support, which can be integrated into existing teacher support systems as well as through peer learning and through head teachers.

- **Understand and work within the existing system**
  Effective implementation and sustainability of an EdTech model will often depend upon the school and government driving the EdTech innovation forwards. This requires designing with government from the outset, working within existing systems and structures and ensuring schools and government have ownership. In the ESSPIN EdTech pilots, schools were encouraged to develop supportive policies and schedules for implementation and government officials were trained to provide ongoing support, oversight and monitoring. However, in complex environments the existing education system may not be working as planned, thorough risk analysis and local knowledge can help create solutions to mitigate against barriers within the system.

- **Evaluate and disseminate evidence of impact**
  Both users and implementers should be encouraged to constantly evaluate and experiment with the EdTech model in order to learn, adapt and improve. Observing and measuring what happens in practice is key to demonstrate impact and make comparison with other

approaches, especially non-tech approaches. Solid evidence of impact can be used to advocate for scale up of successful innovations.

- **Ensure a broad range of stakeholders, including beneficiaries, contribute to digital design**
  Designing with stakeholders (e.g. government, schools, teachers, children) from the outset will ensure the EdTech model is embedded in stakeholder policies, frameworks and structures and can support sustainability of the project. When designing digital content for learners it is critical to engage beneficiaries to ensure content is culturally relevant and suited to ability levels of the pupils.

- **Devices must be simple and user friendly for users with no prior knowledge or experience with technology**
  In an environment where users have limited or no technical know-how and infrastructure and connectivity are unreliable, it is essential that the EdTech devices are easy to operate and maintain. Simple devices that can be used without internet connectivity or electricity are successful in Nigeria, for example radio. Similarly, free and simple to use software packages were successful in the ESSPIN pilots. Simplicity encourages regular use and use after the programme implementers have gone.

- **Use technology as an enabler in EMIS**
  Introduction of technology was well received amongst government officers working on EMIS. There is great need and opportunity to digitalise practices in EMIS. Technology enables EMIS officers to collect, synthesize and analyse massive amounts of data in a fast and cost-effective way. It also enables users to take advantage of new types of data such as GIS. In ESSPIN the use of technology in EMIS went hand in hand with a decentralised approach which ensured reliable school data is available to stakeholders at all levels of the education system.

- **EdTech solutions should be cost-effective**
  Insufficient funding provided a common reason why many pilots in ESSPIN were not scaled up. Currently across the globe most EdTech pilots are exploratory pilots which lack the capacity to reach large numbers of learners over long periods of time and cost is a key barrier to scale up. During design the costs of implementation should be analysed to consider value for money, especially in comparison with non-tech interventions. Throughout the programme these should be revisited and impact communicated to relevant stakeholders.