TRACK AND TRACE

Can a Digital Book Tracking System Help to Get Books into the Hands of Children?

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Digital book tracking systems have potential to address some major book supply challenges by providing accurate and easy to access information on the status of books along the supply chain.

Photo courtesy of GPE/Chantal Rigaud

Many countries do not have efficient systems for ordering and tracking the delivery of books, which results in delays, leakages, and inaccuracies in the supply of textbooks to schools.

Results-based financing can help countries tackle these challenges by incentivizing stakeholders to ensure that children receive quality books.

The Results in Education for All Children (REACH) Trust Fund supports and disseminates research on the impact of results-based financing on learning outcomes. The EVIDENCE series highlights REACH grants around the world to provide empirical evidence and operational lessons helpful in the design and implementation of successful performance-based programs.

Reading is a gateway to learning as a child progresses through school. However, many children around the world are not learning to read proficiently. The World Bank recently shone a spotlight on the global learning crisis by introducing the concept of "learning poverty," by which measure more than half (53 percent) of 10-year-olds in low- and middle-income countries cannot read or understand a simple text. In poor countries, the rate is as high as 80 percent.[1] One way to reduce learning poverty and improve reading proficiency among children is to give students books to read. Research has shown that providing a student with just one book can improve student achievement by as much as 20 percent.[2] Other research has shown that giving children access to books is a high-impact and cost-effective way to bolster learning outcomes at the primary school level in low- and middle-income countries.[3/4] However, how can children develop reading skills if books never reach them in schools? Many countries do not have efficient systems for ordering and tracking the delivery of books, which results in

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Track and Trace is a book tracking system that makes accurate information on book orders and deliveries accessible to stakeholders in the book supply chain and ensures that books end up in the hands of schoolchildren. Several countries have piloted the Trace and Trace system and have customized it to the needs of their particular book supply chain. The Results in Education for All Children (REACH) Trust Fund at the World Bank has funded the development of book tracking systems in several countries and has tested a results-based approach to incentivizing stakeholders within the textbook supply chain. This note presents an overview of the challenges faced by many countries in this area and describes the main features of the Track and Trace system and how it addresses some of those challenges. While results are still coming in from some Track and Trace projects, the initial data suggest that Track and Trace has the potential to make book supply chains more transparent, timely, and efficient which can enable books to reach schools and help students to learn.

CONTEXT

Some countries average only one textbook per 10 children.

Despite the evidence that shows that the provision of textbooks has a positive effect on learning outcomes, some countries only have an average of one textbook for every 10 children.[5] This shortfall may be because textbooks get lost in the process of being delivered to schools. Alternatively, the books may reach the schools, but they may not be the right books or in the right quality. These problems are often caused by poor book forecasting methods, poor supply chain management, and/or inefficient distribution methods.

In many countries, when schools are forecasting their textbook needs and making their requests, they have to fill out request forms by hand and make carbon copies. These paper-based systems often use complicated formulae that can result in errors when book requests from multiple schools are compiled. For example, in Cambodia before the Track and Trace pilot began, schools sent book request forms to district offices, which then sent them on to provincial offices. From there, they were sent to the Department of Curriculum Development in the central level where officials entered the data manually into Excel spreadsheets. This process was costly, time consuming, and prone to error. It is estimated that collecting and compiling these book requests at the central level took up to six months. As a result of these delays, school directors in Cambodia were expected to calculate their book requirements up to two years in advance.[6] Another example is Zambia, where only 70 percent of schools submitted book requests, of which only 26 percent reported their requests as having been fulfilled, at least partially.[7]

There can also be challenges at the distribution stage, ranging from poor sorting and storage of books to theft. It has been estimated that, in some countries, as many as half of all textbooks are lost or damaged in the distribution and storage processes each year.[8] For example, studies in Guinea and Niger found that 67 percent and 50 to 60 percent of textbooks respectively are lost in the warehousing and transportation process. A 2010 distribution tracking survey in Ghana found that 29 percent of English language books were lost because of the poor quality of district-level storage facilities, poor recordkeeping, a lack of supervision, and the sale of free textbooks to private schools by public school managers. A 2007 report on textbook provision in Zanzibar uncovered poor management and limited resources in warehouses. Deliveries were not carried out on any schedule, books got damaged due to the damp conditions, boxes were stacked in no coherent order, and only one person managed the entire warehouse.[9] In Cambodia, books sent out to the districts were not organized by school, which meant that the books had to be unpacked, sorted, and repacked at the district level to be sent out to the individual schools. All sorting, packing, and labeling was done manually.[10]

WHY WAS TRACK AND TRACE DEVELOPED?

An overarching challenge in many countries is a lack of visibility and accountability in the book supply chain. Without the ability to monitor the status of book orders or track deliveries to school, school leaders and community members are not able to hold district management accountable for failing to deliver

their textbooks. In Cambodia, community members had no role in ordering or tracking books, and neither they nor school leaders had any way of knowing when and how many books would be sent until they actually received them. Without reliable tracking information, government officials responsible for book distribution would not be able to identify any problems in the book delivery system or how to solve them.

The challenges in the book supply chain can be broadly grouped

into three categories: (1) ordering and forecasting; (2) storage and distribution; and (3) accountability and verification. In order to overcome these challenges, what is needed is reliable and easily accessible data on the book requirements of each school and the ability to track books along the book supply chain to their final destination. It is also necessary for schools and communities to be more involved in tracking book orders and holding school leaders and district officers accountable.
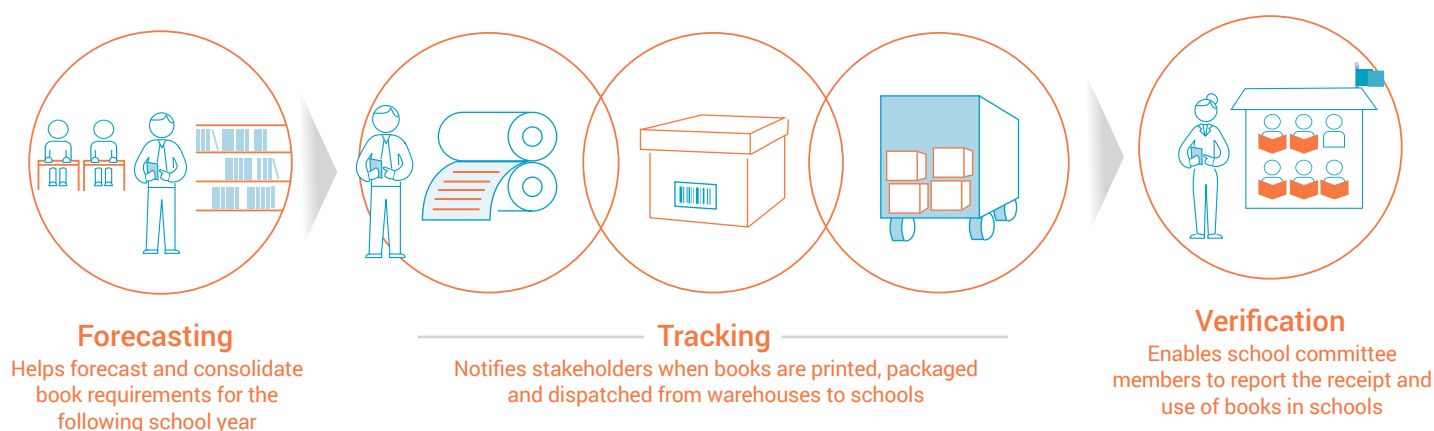
HOW DOES TRACK AND TRACE WORK?

Track and Trace is a technology-driven solution that seeks to bolster weak areas in the book supply chain by increasing the accuracy and availability of information related to book orders and book distribution. Having this kind of information enables decision-makers to accurately pinpoint problems

along the book supply chain such as leakages and delays and to take steps to remedy them. With access to more and more accurate information, decision-makers can also measure the performance of different players along the chain, track progress towards targets, and gauge where improvements are needed.

The Track and Trace model has three main features that make the book ordering and delivery processes more efficient (*Figure 1*):[11]

1. A digital system for quick and accurate forecasting of book requirements: Track and Trace can automatically produce an accurate

Figure 1: Track and Trace Process

Forecasting
Helps forecast and consolidate book requirements for the following school year

Tracking
Notifies stakeholders when books are printed, packaged and dispatched from warehouses to schools

Verification
Enables school committee members to report the receipt and use of books in schools

Source: World Education Inc. 2017. "Explanatory Note: Results-Based Financing for Enhancing Book Distribution in Cambodia."

projection of book requirements based on reports received from schools. It replaces the paper-based process for book requests, which was time-consuming and prone to error and omissions. As these projections can be produced more quickly and accurately, the book budgeting and procurement processes can be started and finalized much sooner than under paper-based systems.

2. Real time tracking of the printing, storage, and distribution of books:

Stakeholders can track books in real time on the Track and Trace system and can identify any problems in the delivery process such as delayed or missing books. For example, the dashboard used in the Track and Trace system shows when the distribution house dispatches books and in what quantities, when the district education department receives them, and when the school directors pick up the book allocations for their schools.

3. Verification of book delivery:

Once schools have received their book allocations, Track and Trace makes it possible for spot checks to be made in classrooms to ensure that the right books have been received on time and in the correct quantities.

Track and Trace makes each step of the ordering and distribution process visible to all stakeholders, which results in greater transparency and greater accountability. The system enables schools and other stakeholders to stay informed about the status of book deliveries and to hold government representatives accountable if needed. By providing reliable and timely information and by making books traceable at all points of the supply chain, Track and Trace increases the effectiveness of the book supply chain and helps to ensure that the right books are delivered in the right amounts and condition and at the right time to schools and into the hands of students.

COMMUNICATION TECHNOLOGIES USED IN TRACK AND TRACE

The Track and Trace system uses a combination of user-friendly and cost-effective communication technologies, including barcodes, short message service (SMS), interactive voice response (IVR), smartphone applications, chatbots, and web-based dashboards. In combination, these technologies help to make the book supply chain more accurate, visible, and accountable. For example, if a school has not submitted its book requests, the system sends it a chatbot alert as a reminder. Also, the system can alert the relevant staff in the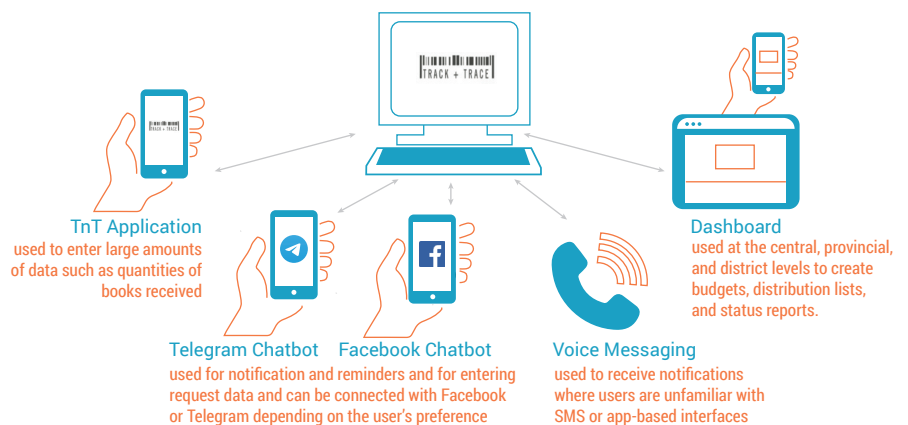 districts and at the central level when books go missing, and schools can access the system to inquire about the status of their book deliveries.

In most of the countries where the Track and Trace system has been piloted, a survey has been conducted during the design phase to assess the extent to which each technology can be used by stakeholders. The results of these surveys have been used to determine the best technology options for the capacity of each user group. For example, in Cambodia, World Education Inc conducted a technology use survey that revealed that school committee members mostly used basic phones (only 20 percent had smart phones), and none used text messaging.[12] Hence, a voice message feature was incorporated for that user group. Figure 2 describes some of the communication technologies used in Track and Trace systems.

APPLICATIONS AROUND THE WORLD

Since Track and Trace was first developed and tested in Malawi by

Figure 2: Track and Trace Communication Technologies

TnT Application
used to enter large amounts of data such as quantities of books received

Telegram Chatbot
used for notification and reminders and for entering request data and can be connected with Facebook or Telegram depending on the user's preference

Facebook Chatbot

Voice Messaging
used to receive notifications where users are unfamiliar with SMS or app-based interfaces

Dashboard
used at the central, provincial, and district levels to create budgets, distribution lists, and status reports.

Source: World Education Inc. 2017. "Explanatory Note: Results-Based Financing for Enhancing Book Distribution in Cambodia."

John Snow Inc and World Education Inc in 2015, several variations of the system have been tested in other countries. The systems have some differences, but each makes it easy to access accurate information on book orders and book locations. The Track and Trace systems that exist in other countries include:

- **Nigeria: Northern Education Initiative Plus program.** The Education Development Center (EDC) introduced a Track and Trace system that uses an offline tablet-based systems for data collection and digital dashboards to enable monitoring of the status and progress of deliveries.

- **Afghanistan: Afghan Children Read Program.** A Trace and Trace system developed by Creative Associates International provides a new labeling system for book shipments, book tracking applications, SMS-based notifications, and real-time status reports.

- **Malawi: OpenEMIS Logistics.** This system tracked the delivery of books to schools using a web interface, a mobile-based application, and text messaging (SMS) and can be used both online and offline.

- **Ethiopia and Honduras:** USAID and blueTree Group have supported Track and Trace projects in Honduras and Ethiopia that use SMS and app-based technologies. The alpha and beta tests of the Track and Trace system in Honduras were conducted in February and July 2019 respectively. The alpha test in Ethiopia was conducted in August 2019, and the beta test started after that.

- **Cambodia, Niger, Nepal, and India: REACH-supported programs.** The World Bank's Results in Education

Textbooks being delivered. Photo courtesy of the World Bank

for All Children (REACH) Trust Fund has supported projects in these countries that track books along the book supply chain and that include elements of results-based financing (see *Box 1*).

WHAT WERE THE RESULTS?

RESULTS OF TRACK AND TRACE IN CAMBODIA

The Cambodia Track and Trace Project successfully collected book requests from 416 primary schools in just two weeks using the system, whereas under the paper-based system, it would have taken up to six months.[13] One hundred percent of the 624 school officials and 832 school support committee members who had been trained to participate in this project were able to successfully submit their requests.

However, in this pilot, the book request exercise was done as a trial and did not inform the actual number of books printed and distributed in pilot schools. Instead, the books distributed using the Track and Trace system were based on an allocation list that had already been prepared using the paper-based system and approved by the government. It is expected that the next iteration of the project, the Track and Trace system will be used to determine the book allocation for each school.

Key officials were able to track deliveries through the system and to learn when and how many books were received. Data on the Track and Trace system showed that 99 percent of the books allocated to the pilot schools were received by the school directors and that 94 percent of the school directors' digital receipts exactly matched the approved quantities of textbooks allocated to that school.[14] In terms of time, the delivery of books from warehouses to schools generally took only one to two days, which was significantly faster than the approximately 10 days that it took for all school directors to collect their textbooks under the old system.

Ninety-two percent of school committee members conducted at least one spot check of book

Box 1: How Can Results-Based Financing Incentivize Book Delivery?

The Results in Education for All Children (REACH) Trust Fund under the World Bank aims to strengthen education systems using results-based financing (RBF) and incentives. This approach involves the provision of financial or other rewards in return for specific verifiable outcomes, with the goal of strengthening the focus on results. REACH partnered with the Global Book Alliance (a group of donors, multilateral institutions, and civil society organizations committed to bringing books to every child in the world by 2030) to test RBF models in four countries and to explore how it could facilitate the delivery of books to schools. For example, Track and Trace in Cambodia rewarded community members for monitoring the receipt of books by schools and whether the books were actually being used by the schoolchildren. These rewards took the form of public recognition.

When accurate information is available through book tracking systems, incentives can be introduced at various stages of the book chain to reward the achievement of results. For the second phase of the Cambodia Track and Trace project, government officials have expressed an interest in tying the return of a 10 percent deposit paid by the printing and distribution facility to the achievement of their targets that will be tracked using the Track and Trace system. The table below summarizes the book tracking initiatives supported by REACH, including the actors incentivized and the incentives used.

Book Tracking Innovations Supported by REACH				
Country	**Challenges**	**Solution**	**Actors Incentivized**	**Incentives**
Cambodia: Phase 1 (2017) Phase 2 (2020)	Long procurement lead times, little visibility of data, lack of leadership and commitment on how data were used	A technology-based solution that enables stakeholders to track the ordering and distribution of books in real time	1. School communities 2. Printers and distributors	1. Rewards and recognition 2. Predelivery payment and post-delivery return of deposit
Nepal (2018)	Per child funds not used for book procurement, publishers not in the school market, bookstores not accessible	A digital platform that tracks and verifies school purchases of books and provides incentives to use the platform	1. Publishers 2. Schools 3. Head teachers	1. Performance-based contracting 2. Bonus books, prizes 3. Prizes, appreciation letters
Niger (2019)	Limited accountability and verification of book distribution, books stuck in warehouses	A digital tracking tool that uses accessible technology options (such as SMS) and community verification of book deliveries	1. School communities	1. Public recognition
India (2020)	Delays in book demand data, storage/transport difficulties, little visibility of the process, delays in book deliveries to school	Tech-enabled tools to track information on the distribution, storage, and delivery of books	1. Printers/publishers/ distributors 2. Government 3. Schools	1. Staggered payments, certification, networking 2. Link with appraisals 3. Recognition, more funds

availability at their school and 97 percent of the committee members' receipts matched the school directors' receipts. Prior to Track and Trace, book deliveries were not double-checked, and there was no community involvement.

The system also kept key officials informed about the timeliness of and any delays in the delivery of books. It provided data showing that 86 percent of book deliveries were received by schools in January of the 2018–19 school year, 5 percent in May, and 9 percent in June. Delays in the government's procurement of books resulted in significant delays in books becoming available in the central warehouses and, thus, in being dispatched to districts. Although Track and Trace was not designed to address government procurement challenges in the book chain, it was able to provide useful and accurate information on delays that had not previously been available.

The running costs of Track and Trace are projected to be lower than the total cost of lost books in the current system. The cost of expanding the Track and Trace system nationwide in Cambodia is estimated to be between US$5,000 and US$12,500 depending on whether a not-for-profit or a for-profit model is used. In comparison, the cost of losing just 2 percent of contracted textbooks in Cambodia is estimated to be approximately US$206,000. Therefore, the Track and Trace system has the potential not only to pay for itself but also to yield considerable savings for the government even if there is only a small reduction in book losses.[15]

RESULTS OF OTHER TRACK AND TRACE PROGRAMS

Track and Trace in Afghanistan tracked the supply and delivery of more than half a million teaching and learning materials and was initially used in more than 560 schools and community education centers.[16] This led to the development of the Online Textbook Inventory Management System (OTIMS), which piloted the distribution of more than 840,000 books to over 1,070 school and community education centers in Afghanistan.

Book tracking initiatives in other countries have had promising initial results although currently only a limited amount of data is available. In Honduras, the Track and Trace pilot confirmed the delivery of books to 95 percent of schools, and there are plans to scale up the system to deliver books to more than 1,000 schools. In Malawi, the Track and Trace system was piloted by John Snow, Inc and was demonstrated to have increased the transparency of book deliveries to schools and to have engaged parents and teachers in the distribution process. Although it did not provide data on the number of successful deliveries, the system paved the way for similar systems to be adopted in other countries. Similarly, results from the Track and Trace system used in Nigeria were not available at the time of this report. However, members of the team who implemented the system report that it has significantly sped up the book ordering and delivery processes: "There is a tremendous improvement in the time taken to deliver books to schools once they have arrived at the state and local warehouses. Similarly, the system has improved the process of estimating the quantities of books that need to be printed and of tracking books at all levels."

Mr. Samchivien, a school director in Banteay Meanchey province, uses his smartphone to request textbooks through the TnT system. Photo courtesy of the World Bank

GOING FORWARD

The evidence from the application of Track and Trace in Cambodia and a few other countries shows its potential to provide a cost-effective and scalable solution to some major book supply challenges faced by many developing countries. When the right books reach schools and students, the process of teaching and learning to read can begin. At the time of the publication of this report, the results of Track and Trace system piloted in Cambodia were available and the system was being improved for scale up at a national level. However, the other tracking systems discussed here are still at the implementation or testing stage so there is limited data on how well these systems are succeeding in delivering books into the hands of schoolchildren.

One of REACH's main objectives is to fill gaps in the evidence base on when and how incentives can be used to motivate stakeholders to focus more on producing the best possible results. Going forward, evaluations of the scale-up of Track and Trace in Cambodia and of the interventions in Nepal, Niger, and India will yield evidence to inform the design and implementation of book tracking systems in similar country contexts.

1   World Bank. 2019. *Ending Learning Poverty: What Will It Take?* Washington, DC: World Bank.

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3   Boissiere, Maurice. 2004. "Determinants of Primary Education Outcomes in Developing Countries," Background Paper for the Evaluation of the World Bank's Support to Primary Education, World Bank, Washington, DC.

4   Read, Tony. 2015. "Where Have All the Textbooks Gone? Toward Sustainable Provision of Teaching and Learning Materials in Sub-Saharan Africa." pg. 33

5   UNESCO Institute for Statistics data. http://data.uis.unesco.org/index.aspx?queryid=195&lang=en

6   World Education Inc. 2017. "Explanatory Note: Results-Based Financing for Enhancing Book Distribution in Cambodia." pg. 32.

7   World Bank. 2016. "Education Public Expenditure Review in Zambia." World Bank, Washington, DC. pg. 67.

8   Read, Tony. 2015. "Where Have All the Textbooks Gone? Toward Sustainable Provision of Teaching and Learning Materials in Sub-Saharan Africa." pg. 12

9   Ibid.

10 World Education Inc. 2017. "Explanatory Note: Results-Based Financing for Enhancing Book Distribution in Cambodia." pg. 35.

11 The features and diagrams for the Track and Trace workflows are from the platform designed by World Education, Inc. and John Snow, Inc. in Cambodia, which was used on an experimental basis in that country between 2018 and 2019.

12 World Education Inc. 2017. "Explanatory Note: Results-Based Financing for Enhancing Book Distribution in Cambodia." pg. 38.

13 World Education Inc. 2017. "Explanatory Note: Results-Based Financing for Enhancing Book Distribution in Cambodia." pg. 34.

14 There were some instances where the total number of books received by the school was correct, but specific books were oversupplied or undersupplied.

15 World Education Inc. 2017. "Explanatory Note: Results-Based Financing for Enhancing Book Distribution in Cambodia." pg. 35.

16 Results from the launch phase in 2017. Current number of book deliveries may be greater than the number mentioned here.