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DIGITAL TRANSFORMATION IN TEXTBOOKS SUPPLY CHAIN IN CAMBODIA

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ABSTRACT

Cambodian primary schools often encounter challenges in sourcing textbooks. Inefficient manual processes were used before the introduction of Track and Trace (TnT) in 2022, a digital solution that aimed to streamline the textbook supply chain. This research aims to (1) explore the motivations behind the development of TnT and (2) understand the effects on the roles of users. A qualitative method was employed with 25 semi-structured interviews across five provinces. Interviewees ranged from development partners, ministry officials, education administrators, primary school directors, and school support committees. The results showed that the primary goals behind TnT were: accurate textbook forecasting, eliminating inefficiencies; and, promoting transparency and accountability throughout the process. While the Publishing and Distribution House have experienced significant changes in their roles due to TnT, further training and technical support are needed for users, especially school directors, to fully leverage the system's potential and ensure smooth implementation at the school level.

KEYWORDS

Textbooks Supply Chain,
Technological Adoption,
Track and Trace (TnT),
Primary Education,
Cambodia

Introduction

In the fertile ground of primary education, textbooks are the seeds that nurture the growth of literacy, numeracy, and critical thinking. Well-developed textbooks equip students with essential knowledge that ignites their curiosity, fostering analytical reasoning and problem-solving skills. These pillars are particularly vital at the primary education level, laying the foundation for a strong reading foundation (EDC 2020). The primary resource of self-study, a cornerstone of knowledge acquisition, is also driven by textbooks (Mithans and Ivanuš Grmek 2020). However, the absence or inadequacy of textbooks can adversely affect students' academic progress and further exacerbate educational inequalities (Fuji et al., 2021; World Bank 2020a). This problem is also reflected in the Cambodian context. There were reports of limited textbooks and other reading materials both in terms of quantity and quality, the consequences of

which could have contributed to poor numeracy and literacy performance. This was evidenced in both the Early Grade Reading Assessment (EGRA) and the Program for International Student Assessment for Development (PISA-D), which showed weak literacy and numeracy performance among Cambodia's primary school students (World Education 2021; World Bank 2020b; KIND 2014). This highlighted the urgent need for equitable access to quality resources so that every pupil can unlock their full potential.

The global adoption of digital technology has facilitated the development of the educational landscape. Technological change is sweeping through the system, ranging from teaching and learning, financing, and governing to even the management of educational resources like textbooks (GEM Report 2023). This same trend is also present in Cambodia, where in 2020, the Ministry of Education, Youths and Sports (MoEYS) adopted

Track and Trace (TnT), a digital intervention for managing the supply of textbooks nationwide (MoEYS 2020). Nevertheless, there remains a scarcity of studies on either the textbook supply chain or its progress with digital technology (Bun et al., 2022; Jarvis and Lalonde 2006; Kearthland 1992). Therefore, this study aims to document the perceived motivation and purpose of developing and implementing TnT as well as to explore whether there are any changes to the roles of stakeholders involved in the Cambodia textbook supply chain.

Development of textbook supply chain and the new practice

Generally, a textbook supply chain involves the process of planning, developing titles, publishing and printing, procurement and purchasing, and delivering and distributing to the end users (GBA 2020). Each step is interrelated, and either its efficiency or fault can impact the whole supply chain and, eventually, the accessibility of books to readers.

In Rwanda, the issues of textbook shortages and late delivery were prominent. The 2007 study by the Rwanda government showed that the first-grade science textbook ratio was 265:1 while there were also high dysfunctional storage, distribution and delivery. To tackle these problems, the government of Rwanda teamed up with development partners to pioneer a new intervention focussing on the set-up of an electronic system to manage the textbook distribution system; this was called the Management Information System (MIS) (GPE Secretariat 2013; UNESCO 2013). With this computerised system, schools in Rwanda can both view the stocklist and place orders. The distributors can then download the number of orders and access details relating to deliveries and payments. Moreover, the Rwanda Ministry of Education (MoE) can also view the whole cycle of this system, including monitoring the provision of textbooks. It also helped the school track their orders and delivery progress (Read 2016).

Before 2020, Cambodia's textbook supply chain was hindered by lengthy procedures and manual processes (World Bank 2020b). Handwritten textbook requests were prone to errors and delays, often taking months to retrieve approval and reach

students. While past development efforts by ADB, World Bank, and UNICEF focused on textbook creation and production, the distribution system remained archaic, leaving many schools without key resources that facilitate and enhance students' learning. Recognising the urgent need for a transformative solution, in 2017, MoEYS partnered with World Education to pilot TnT. Within two weeks, the system collected textbook requests from all 416 pilot schools, a feat that previously took at least six months (World Bank 2020c). This dramatic shift not only alleviated MoEYS officials from the paperwork burden but also empowered school directors to dedicate more time to their students. Following successful piloting, TnT is now operational nationwide to manage the demand for and supply of textbooks. TnT's success marks a significant step toward equitable access to quality education in Cambodia, paving the way not just for supplying textbooks but possibly for further expansion and integration of additional educational resources.

Methodology

This paper adopted a qualitative approach. Data collection was obtained from 25 semi-structured interviews conducted in Phnom Penh and four other provinces (Banteay Meanchey, Monduliri, Sihanouk Ville, and Prey Veng). Interviewees were grouped into two levels: strategic-level and operational-level. Strategic-level interviewees were individuals involved in developing policy and implementation support strategies around TnT, such as the Primary Education Department (PED), Publishing and Distribution House (PDH), Office of Planning and Textbook Distribution (OPTD) of the Department of Curriculum Development (DCD), World Education Inc. (WEI), and MoEYS. Operational-level interviewees are simply those who implemented or used TnT, such as the Provincial Office of Education (PoE), District Office of Education (DoE), School Directors and School Management Committees, or School Support Committee (SMC/SSC). Transcribing and thematic data analysis were conducted via the qualitative analysis software, Nvivo.

Findings and discussion

Purpose of TnT creation

Four recurring themes emerged when questioning participants about their knowledge of the purpose of developing and using TnT.

Commonly, participants from both strategic and operational-level groups perceived TnT as a tool that can significantly help to **reduce their workload in textbook forecasting and requesting**. Prior to TnT, inefficient handwritten forms and manual data entry led to errors, delays, and difficulties in accurately tracking both textbook demand and supply. Multi-stage approvals, lost documents, and illegible handwriting often compounded these challenges. TnT has streamlined the process with digital forms, real-time tracking, and improved data accuracy, ensuring smoother textbook distribution.

One of the motivations for developing TnT was when they noticed my team's difficulties in collecting and sending hardcopy data and documents back and forth with PoEs, DoEs, and schools. In the past, such data entry tasks would demand all of my 12 staff to work for months. [SG3].

Both TnT user groups also viewed it as **a solution to the persistent mismatch between textbook demand and supply, whether in terms of quantity or title**. This is due to the fact that TnT can help ensure the correct item and consistent calculations of textbook needs in schools. Rigorous textbook projection and confirmation can be automatically generated, reducing human error which previously resulted in the wrong textbook allocation and distribution. Other stakeholders, especially development partners working with schools, have also observed improvements, noting a decrease in textbook mismatches and fewer instances of illegal textbook sales.

Additionally, all participants unanimously agreed that TnT was developed to **boost timely textbook delivery**. By streamlining forecasting and requesting, TnT allows more time for the printing, packing, and delivering phases, ensuring schools receive the correct order of textbooks before the new academic year begins. The elimination of delays ensures that students receive relevant

textbooks by the time they enter their new class. TnT's features, including classroom inspection, textbook confirmation, and the option to report problems, further strengthen the need for the system's development. For more detail on TnT's features, please see Bun et al., 2024.

During the development period, we thought of ways to minimise the problems that we faced in order to allow for a smooth delivery process for the textbooks to finally arrive in the hands of the students. [SD1].

Last but not least, TnT was also reported as **a tool to promote transparency and accountability among stakeholders in the textbook supply chain**. Besides being able to check the number of textbooks requested, confirm textbook receipt, inspect the classroom, and report problems, related government officials can also access the online TnT dashboard to monitor the progress and performance of textbook demand and supply. Such open access to the data and communication from the school level enhances the transparency and accountability of every stakeholder involved. Interestingly, while all the strategic-level participants (e.g. PED, PDH, OPTD) clearly recognised the development purpose of TnT, other stakeholders, especially those at the operational level like PoE, DoE, school directors, and SMCs, seemed less aware. This gap in understanding could hinder TnT's effectiveness in fostering collaboration and open communication as not everyone is knowledgeable about the purpose of the functions and, therefore, does not use them.

The 2020 World Bank report and report from World Education highlighted four main goals of TnT's development, including addressing textbook supply issues, boosting transparency, streamlining processes, and ensuring students' access to textbooks. However, as found in this study, limited awareness of key features like classroom inspection, which empowers SMCs to verify deliveries and confirm the number of textbooks delivered for the students, may contribute to under-utilisation and hinder transparency efforts. To bridge this gap, targeted training and awareness campaigns could educate all stakeholders, particularly PoE, DoE,

Table 1: Comparison of textbook supply chain actors' roles pre and post-TnT

Pre-TnT	Post-TnT
School Director (SD)	
<ol style="list-style-type: none"> 1. Collect textbook-related data to forecast textbook demand and complete the hardcopy textbook request form. 2. Submit the textbook request form to DoE, PoE, and OPTD. 3. Collect and sign the delivery note for the received textbooks. 4. Distribute relevant textbooks to students. 	<ol style="list-style-type: none"> 1. Collect textbook-related data to fill in the online textbook request in TnT. 2. Submit the online textbook request form via TnT. 3. Collect and sign the delivery note for the supplied textbooks. 4. Complete and submit the textbook receipt form in TnT. 5. Distribute textbooks to students.
District Office of Education (DoE)	
<ol style="list-style-type: none"> 1. Notify SD to complete the hardcopy textbook request form. 2. Review textbook requests submitted by school directors within their district. 3. Consolidate all textbook requests into one textbook request form for their district. 4. Submit the consolidated textbook request form to PoE and OPTD. 	<ol style="list-style-type: none"> 1. Liaise with schools that do not complete the textbook request or confirmation via TnT. 2. Confirm receipt of their annual textbook allocation via TnT. 3. Provide training and guidance on using TnT to SDs or other users.
Provincial Office of Education (PoE)	
<ol style="list-style-type: none"> 1. Review consolidated textbook requests submitted by DoE within their province. 2. Consolidate all textbook requests into one textbook request form for their province. 3. Submit the hard copy of the consolidated textbook request and references to OPTD. 	<ol style="list-style-type: none"> 1. Confirm receipt of their annual textbook allocation via TnT. 2. Provide training and guidance on using TnT for SDs or other users.
Office of Planning and Textbook Distribution (OPTD), Department of Curriculum Development	
<ol style="list-style-type: none"> 1. Review and enter textbook request data into computer system. 2. Adjust the textbook request and submit it to the Procurement Unit in MoEYS and MEF for approval of the textbook printing budget and guarantee. 3. Send the final approved textbooks supplied list to PDH and/or the bid-winning printing companies for printing. 	<ol style="list-style-type: none"> 1. Review and approve the textbook request and allocation list.

Publishing and Distribution House (PDH)	
<ol style="list-style-type: none"> 1. Review the textbook printing list, and print and pack the textbooks. 2. Prepare the delivery schedule list and deliver textbooks to schools or school clusters, DoE, or PoE. 3. Collect the textbook receipts and delivery notes for reference. 	<ol style="list-style-type: none"> 1. Notify and support SDs in completing the textbook requests and textbook receipts in TnT. 2. Review textbook requests and confirmation data in the TnT dashboard. 3. Prepare the delivery schedule list and deliver textbooks to schools, DoE, PoE, or school clusters. 4. Collect the textbook receipts and delivery notes for reference. 5. Provide training on using TnT to users like SDs, DoE, and PoE.
School Support Committee/School Management Committee (SSC/SMC)	
<ol style="list-style-type: none"> 1. No specific role 2. Case-by-case textbook donation 	<ol style="list-style-type: none"> 1. Conduct spot-check or classroom inspection 2. Case-by-case textbook donation
Ministry of Education, Youth and Sport (MoEYS)	
<ol style="list-style-type: none"> 1. Review and update the textbook curriculum. 2. Review and approve textbook requests and the textbook printing budget. 3. Review and approve the procurement process for textbook printing. 4. Conduct a physical textbook inspection during printing and before delivering to schools. 	Their role remains the same.

school directors, and SMCs, about TnT's less popular functions and their crucial roles in ensuring an efficient and effective textbook supply chain. This focus on transparency extends to the relationship not just between the Ministry of Economic and Finance (MEF) and the Ministry of Education, Youth, and Sport (MoEYS) but also between other involved stakeholders. The TnT dashboard grants relevant ministry officials direct access to data on textbook requests, losses, and damages, allowing them to verify the financial budget allocated for textbook provision. This real-time data transparency empowers MEF to make informed decisions about budget allocation and resource distribution, ensuring efficient and responsible use of funds for student education.

The changing roles of stakeholders involved in the textbook supply chain

Prior to the implementation of TnT, there were five main stakeholders or actors in the Cambodian

primary school textbook supply chain. These included the school directors, DoE, PoE, OPTD, PDH, and MoEYS. These actors performed various tasks ranging from textbook forecasting and planning, title development, and printing, to delivering and distributing. As previously discussed above, this process was laborious and time-consuming since almost all administrative work was paper-based and required many bureaucratic approvals.

Such rigid processes, however, have been streamlined since the introduction of TnT. Noticeably, the majority of DoEs, PoEs, and OPTDs' responsibilities in the textbook supply chain are now automated and directed to PDH, the main textbook supplier. Interestingly, it is observed that there is a new emergence of actors involved in the textbook supply chain. These are the SSC/SMC whose role is to help conduct classroom inspections for TnT. This task is also a mechanism aiming to improve transparency and accountability in the textbook supply chain.

Despite the perceived efficiency that was brought about by the alterations in the roles of actors in the textbook supply chain, some interviewed participants also revealed shortfalls that should be taken into account. With the current workflow of TnT, both DoE and PoE seemed to have little information regarding textbook demand and supply of schools under their management. They are also not able to help notify or remind their schools to complete the online textbook requests and receipts forms until they first receive a request from PDH to do so. Such a process can result two particular issues. First, it can create delays in the monitoring mechanism of this new digitalised textbook management system. Second, it can lead to knowledge gaps or missing information among DoEs and PoEs, who should be aware of the status and performance of schools under their authority.

The limited capacity of both existing and new actors using TnT in the textbook supply chain is also problematic. This challenge, however, is not only related to the disparity between digital tools and connectivity but also the actors' knowledge and understanding of using relevant functions in TnT. For example, not many appointed or volunteer SSC/SMCs have smartphones, and their digital literacy is low, making using TnT a challenge. To date, there has not been substantial training or orientation in using functions in TnT for different actors. This will also lead to gaps in understanding for others involved in the system and how they can communicate in working together in the same textbook supply chain.

Conclusion and recommendations

Preceding TnT, textbook requests were a laborious, multi-step process involving multiple offices. TnT streamlines this by allowing schools to directly submit data, significantly reshaping stakeholder roles. This shift highlights the impressive adaptability of educational officials in embracing technology. Despite the new efficiencies, concerns remain. TnT operational-level users often fail to leverage its transparency and accountability features. This knowledge gap impedes collaboration and efficient system adoption. Information gaps

hinder timely responses by DoE and PoE, often relying on PDH prompts for school communication. Additionally, limited user capacity due to digital tool disparities, low digital literacy, and insufficient training barricade communication and collaboration across the supply chain. Addressing these issues is vital for seamless system operation and maximising TnT's potential.

To bridge the knowledge gap among operational-level stakeholders, MoEYS should launch another round of TnT training nationwide, whether in-person, online, or hybrid. The training should focus on explaining TnT's core purpose, features, and benefits in clear, concise language relevant to their responsible tasks. PDH can spearhead this effort by organising workshops and webinars and developing training materials integrated with existing learning resources. Empowering stakeholders to understand and utilise TnT will unlock its full potential. Furthermore, bridging the information gap between schools, DoE, and PoE is crucial for enhancing communication and coordination. A new function within the TnT dashboard, granting DoE and PoE access to schools' textbook requests and confirmations, would be a valuable step. This real-time information would enable them to monitor progress, provide timely support, and contribute to accurate demand forecasting, minimising textbook over- or under-supply.

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