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Driving Informed EdTech Quality Decisionmaking: A Research-Practice Partnership-Based Solution for Diverse Stakeholders' Needs

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Abstract: In the educational technology (EdTech) ecosystem, stakeholders such as government decision-makers, entrepreneurs, parents and teachers face challenges in making informed decisions about the quality of EdTech products that meet their varied needs. While numerous frameworks exist that address diverse stakeholders, there is a lack of customizable frameworks that cater to each of the stakeholders' requirements, especially in lower-middle-income countries. This paper presents the EdTech Tulna initiative, a Research-Practice Partnership (RPP) aimed at building a shared understanding of what constitutes 'good' quality EdTech. This partnership between the research group, non-profit organization and diverse stakeholders presents a unique solution for varied needs and purposes. An analysis of the EdTech Tulna initiative's key offering is provided, which is the robust Tulna framework that supports stakeholders in making informed decisions about the quality of EdTech. The paper examines the design of the Tulna framework and presents case studies on how the framework has been customized to support diverse stakeholders' EdTech quality decision-making. This paper contributes to understanding an RPP's dynamics. It also promotes the discourse on the usefulness of research-based frameworks to drive EdTech Quality decision-making for diverse stakeholders' needs.

Keywords: Stakeholders, research practice partnership, EdTech Tulna, EdTech quality decision making, framework

1. Introduction

Across the globe, there has been a surge in educational technology (EdTech) demand and supply. The pandemic exacerbated the growth of EdTech, particularly in lower-middle-income countries (LMICs) (Cueto et al., 2023). Given the overwhelming rise in EdTech products, UNESCO (2023) has recommended that stakeholders such as governments base their procurement and scaling-up decisions on reliable evidence that carefully considers pedagogical elements. However, research has found that evidence is not a primary concern in the decision-making process regarding the adoption and scaling of EdTech initiatives (Olsen, 2023). The goals in EdTech ecosystems, especially in the LMICs, are often loosely, poorly, or ill-defined (Vithanage et al., 2023). As a result, the hype of new technology can end up driving decisions without much consideration about the purpose of using the technology (Cueto et al., 2023). Importantly, there is a lack of informed decision-making about the quality of EdTech that is aligned with specific educational needs. This problem is systemic in nature as it involves diverse stakeholders who possess varied needs at different levels of the education ecosystem. The varied needs of the stakeholders include governments' need for large-scale procurement of EdTech products (OECD, 2023). Parents' needs are to supplement learning at home using easy-to-use technology (Saez EM et al., 2021). Teachers are required to make an informed choice of EdTech tools that will effectively address their teaching and learning objectives (Ishika & Murthy, 2021). Meanwhile, entrepreneurs need

EdTech products that are built with sound evidence (Moeini, 2020). To aid in making informed decisions that cater to the diverse needs of stakeholders, Government Social Research (2022) found that stakeholders' believed that the use of frameworks supported their EdTech decision-making. This underscores the need for a robust quality framework that caters to different stakeholders' needs.

The *EdTech Tulna initiative* (EdTech Tulna, 2024) was founded in 2020 as a Research Practice Partnership (RPP) in India (Patel et al., 2021), between the Educational Technology department at a premier research institute and a non-governmental organization (NGO) that focuses on technology, policy and strategy. The primary goal of the initiative is to improve quality on both the supply and demand side of the EdTech ecosystem. In doing so, it aims to reduce information asymmetry by building a shared understanding of what constitutes 'good' quality EdTech. Towards this aim, reliable and valid frameworks were developed for evaluating EdTech product design and made available on the website as a public good. The initiative also actively supports stakeholders' EdTech decision-making in various settings, ranging from large-scale procurement of quality EdTech products by state governments to selection of EdTech products by teachers for their specific needs (Bhattacharya et.al., 2024). Moreover, the initiative informs the larger ecosystem about EdTech quality standards by offering capacity-building sessions to both local stakeholders and international organizations.

In this paper, we present the EdTech Tulna framework that was designed as a part of the EdTech Tulna initiative. We analyze the way in which the framework has been structured to address the needs of diverse stakeholders for making decisions regarding the quality of EdTech. We employ a case study method to provide evidence for how the frameworks were customized for 3 diverse stakeholders. This paper contributes to the discourse on integrating research-based frameworks for EdTech quality decision-making by providing a robust framework and customization process that caters to diverse stakeholders' needs.

2. Related Work

There exists various frameworks and guidelines to support the effective implementation and assessment of EdTech solutions across different countries. They cater to multiple purposes such as evaluation, selection, suitability, scalability, sustainability, and usability of EdTech. Bapna et.al. (2021) identified 17 EdTech frameworks that position EdTech at different levels (macro, meso, micro, and multi-levels) for diverse stakeholders. Macro-level frameworks are intended for policymakers like "PISA ICT Framework" (OECD, 2020) and the "SABER-ICT Framework" (Trucano, 2016). Meso-level frameworks are for educational institutions and heads of the institution such as "The Holistic Integration Framework" (Khudair & Abdalla, 2016) and "The Framework for Stakeholder Inclusion" (CoAction Learning Lab, 2019). Micro-level frameworks are for teachers such as "TPACK" (Mishra, 2019) and "T3 framework" (Magana, 2020). Multi-level frameworks are for multi-stakeholders like the "Framework for Evaluation Appropriateness of EdTech" (Osterweil et al., 2016), which is for teachers, educational institutions, technology providers, policymakers, and state-level administrators.

Some frameworks provide detailed guides that support EdTech Quality decision-making, whereas others are checklists for rating the quality of products. For example, "EdSurge Product Index & Decision Guide" and "ISTE Seal of Alignment Framework" provide comprehensive indicators for evaluating the quality of EdTech solutions. The Learning Object Review Instrument" (LORI) (Leacock et al., 2007) is an instrument intended for expert-use, consisting of rating scales and comment fields, however it lacks detailed scale descriptors. RPPs such as Digital Promise have created "The EdTech Pilot Framework" that helps education leaders and technology developers run successful EdTech pilots in the USA.

While these frameworks are valuable, there is a need for frameworks created by an RPP that offers customizable resources that aid diverse stakeholders at different levels of the education ecosystem in making informed decisions about EdTech quality in LMICs. A framework created by an RPP is essential as it can help improve the relevance of a framework which is designed in research by focusing on questions of concern to diverse stakeholders like educators and communities (National Research Council, 2012). The EdTech Tulna initiative was designed to address these gaps by providing a robust, customizable, and

evidence-based framework tailored to the LMIC contexts. The EdTech Tulna framework, hereafter referred to as the Tulna framework, constitutes resources that are customizable for diverse stakeholders' needs.

3. Framework

The Tulna framework (Figure 1) posits that EdTech quality decision-making is driven by customizable *resources* that are influenced by stakeholders' needs. S*tandards* underpin these resources, which are informed by the *basis* that comprise educational theories and practices.

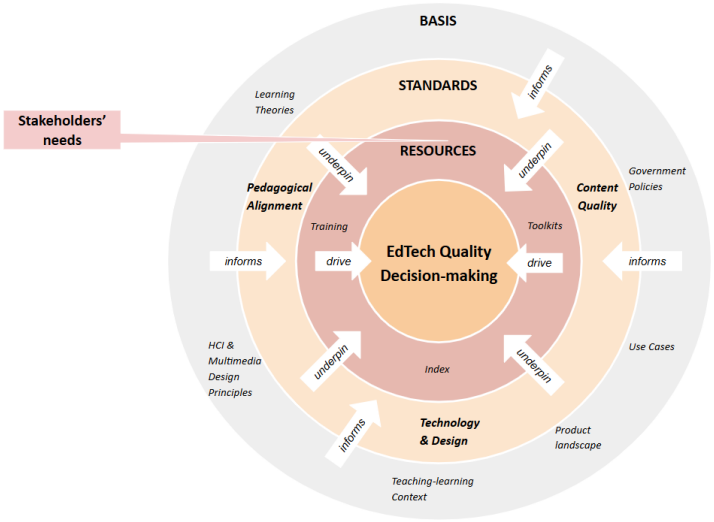

Figure 1. EdTech Tulna Framework

3.1 Basis

The Basis of the Tulna framework which is influenced by government policies, learning theories, Human-Computer Interaction (HCI), multimedia learning principles, the existing product landscape, diverse use cases, and the teaching-learning context (Figure 1). The Basis of the Tulna framework draws upon key *Government policies* such as the National Curriculum Framework (NCF, 2005) and the National Education Policy (NEP, 2020), which emphasize integrating educational technologies within the teaching-learning process. Additionally, Tulna's design draws on various *Learning theories*, such as meaningful learning with ICT (Howland et al., 2013), TPACK (Koehler & Mishra, 2009), and Constructive Alignment (Biggs, 1996). It incorporates strategies like formative assessment (Nicol & Macfarlane-Dick, 2006), constructive feedback, scaffolding (Quintana et al., 2018), and situated learning (Lave & Wenger, 1991). It also is informed by *HCI* and *Multimedia Design Principles* such as user interface design (Norman, 2013) and universal design for learning (Meyer, 2006). The framework considers the existing *Product Landscape* and diverse product *Use-cases*. For instance, the Tulna framework for personalized adaptive learning (PAL) solutions draws upon the assets of the PAL products that were found in the landscape. The frameworks are also categorized by Use-Case, which includes subjects, type of technology and grade. By addressing specific needs across subjects and grade levels, Tulna ensures that it meets the varied requirements of different EdTech products and *Teaching-Learning contexts (*Bransford et. al., 2000; Soundararaj et.al., 2022*)*, particularly for learners in India. These frameworks can be applicable to other low- and middle-income countries (LMICs) as well.

The factors within the *Basis* level collectively inform the *Standards* of the framework, ensuring that the framework has a strong foundation that draws from seminal teaching-learning theories and practices for the intended learners.

3.2 Standards

The *Standards* of the framework comprises three dimensions: *Content Quality, Pedagogical Alignment, and Technology & Design* (Figure 1). Each dimension contains multiple criteria. *Content Quality* is the benchmark for ensuring the presence of accurate, relevant, and inclusive content. Sample criteria covered under this dimension include 'Inclusivity in learner representation' that addresses the diversity of target learners in terms of gender, race, socio-economic background, religion, and appearances while creating content. Another criterion is 'language comprehensibility' which uses easily understandable vocabulary and accent, keeping the intended learners in mind. *Pedagogical Alignment* ensures the use of effective pedagogical strategies informed by educational research and policies. Sample criteria covered under this dimension include 'Content in context' which pays close attention to the learner's context (who is learning) and location (where is learning taking place) while designing pedagogy. Another criterion is 'Learner scaffolding' that ensures support for the learner to help them construct the correct mental model of the concept. *Technology and Design* measures how well the technological affordances and user interface design integrate with pedagogy and content to promote a meaningful learning experience. Sample criteria covering this dimension are 'Interface design (intuitive use)' that follow user-centered design principles to help the learner easily understand what action to take while learning a concept and how to take action. Another criterion is 'Meaningful interactivity' that ensures that interactivity features are meaningful to the content being learned. These Standards form the essence of the framework.

3.3 Resources

The Tulna framework comprises three Resources, namely, *Index, Training, and Toolkit* (Figure 1). The *Index* is an evaluation instrument in the form of a rubric designed to determine the quality of EdTech products. It consists of several criteria, each with detailed guidelines describing what is being measured and what assets to look for during evaluation. A three-point scoring scale with elaborate score descriptors accompanies these criteria. When customized for stakeholders, the Index can take various views, such as the Criteria View and Quant View. The criteria in the index reflect different EdTech use cases, and the reviewer guidelines are aligned to evaluate various domains, including Math, Science, and English. The Index has been validated, and inter-rater reliability was assessed using about 30 EdTech products across different domains, grade ranges, and use cases. *Training* is essential for the accurate usage of the evaluation index. During the training, stakeholders get trained on how to use the evaluation index, they are provided with a detailed explanation of each of the criteria in the index with examples, what to look for in the products for each criteria and how to score them. This ensures that stakeholders can confidently apply the index to their specific needs and contexts. The toolkits consist of items such as process documents, guidelines for conducting evaluations, and customizable scoring sheets with details of the scoring scale. The process documents also offer suggestions for the composition of the evaluation team and provide a detailed day-wise structure for the selection process. Additionally, the toolkit provides government officials with information about the specific EdTech use case being procured and the Tulna initiative in general. These resources are customizable to cater to the diverse needs of multiple stakeholders, thereby driving informed EdTech quality decision-making.

4. Methodology

We used Case Study method (Yin, 2009) to understand how the Tulna framework can be customized to cater to different stakeholders in lower-middle-income countries, specifically India and a few countries in Africa. This methodology is suitable as it allows for an in-depth exploration of how the framework's resources support stakeholders' decision-making regarding EdTech quality. We engaged in a participatory co-design process with diverse stakeholders to customize the framework's resources. Based on these interactions, we tailored the resources to accommodate stakeholders' varied needs. Over three years, we

conducted training sessions for them on the customized framework's resources to assess their usefulness in making informed decisions about EdTech quality. Through feedback surveys and scoresheets, we gathered insights into the framework's usefulness on a 4-point Likert scale, which eliminated neutral responses (Leung, 2011). The questions in the survey forms were based on standardized usefulness survey (Brooke, 1996). Sample survey questions included, "*Did your idea about measuring the quality of EdTech change after the evaluation process*?" and *"Did you find the index easy to use?"* This approach helped us understand how the framework can be adapted to support diverse stakeholders. We carried out nine training sessions for government decision-makers and three sessions for coaches, who in turn trained various groups of EdTech entrepreneurs. We then systematically analyzed the data using content analysis method (Mayring, 2015), focusing on sentences that corresponded to the usage of specific resources of the Tulna Framework.

The research question of the study is: *How does the EdTech Tulna framework support decision-making regarding EdTech quality by diverse stakeholders?* Our study targeted three key stakeholder groups within the educational ecosystem: 18 entrepreneurs, 45 government decision-makers, teachers and parents.

5. Findings

5.1 Government Decision-Makers

Different state governments of India have varied purposes for large-scale procurement based on their unique contexts, including infrastructure, location, and language. These governments appoint decision-makers, who are teachers from different domains, SCERT officials, ICT experts, researchers, among other educationists who represent their states for three purposes. These purposes include self-evaluating their own content, selecting a product from a range of EdTech products, or evaluating the content of a specific product use-case. The Central Square Foundation (CSF), our partner in the RPP, conducted regular meetings with the governments to comprehend their specific needs. Subsequently, they facilitated frequent discussions between the governments and research group to ensure mutual understanding of the needs.

The government decision makers' need a solution that is accessible and easy to understand in a limited time frame. The CSF team said that, "*the state government has a large tender (18000 schools) - so a lighter tulna will be helpful."* To meet the government decision makers' needs, the resources of the framework were customized according to the government decision-makers' needs, namely, the *Index, Training* and *Toolkits*. A 'Quant View' of the Index was created with a numeric scale for ease of use in a short timeframe (Figure 2).

EdTech Tulna

Sr. No.	Description of the Criteria	Score 5	Score 15	Score 30
C6	**Inclusivity in representation of learners** **Does the product include representation of diverse groups that the learners are likely to see around them?** • The content comprises representation in terms of gender, ability (children with special needs), looks (e.g., skin and hair colour, body types), socio-economic groups, religions, etc. • There are no stereotypes associated with the identity that is presented to the learners (e.g., a person of a particular gender/race/caste engaged in a stereotypical job, or mothers being represented as homemakers, and/or the central character of the story being a person with white complexion)	No consideration is given to include diversity leading to very little or insignificant representation of the relevant sections of society. The content reinforces stereotypes.	An attempt has been made to include representation of diverse sections of society wherever required. However, some sections have been missed out, leading to an inadequate representation. The content reinforces stereotypes.	There is an adequate representation of the relevant sections of society wherever required. AND The content does not reinforce stereotypes.

Figure 2. Quant View of the Index

The Training was customized to be interactive for ease of understanding. The training was also conducted in the regional language of the government decision makers and was aligned with the Quant View of the Index. Diverse examples were used in the training, which covered different grade ranges, topics and domains to accommodate the expertise of the government decision makers. The Toolkit includes documents such as recommendations about who should comprise the government decision makers' team, the scoresheet to be used for scoring, the training schedule and details about a use case according to their specific purpose to aid efficiency.

Capacity-building sessions were conducted for nine different types of government procurements using the Tulna framework. Out of which, data from two government procurements were analyzed. A total of forty-five government decision-makers underwent these training sessions. A feedback survey was sent to all these government decision-makers and they responded favorably based on the five usefulness criteria. These showed consistent and high ratings across various criteria as shown in Figure 3. This highlights the effectiveness of the customized framework in assisting government decision-makers in selecting, evaluating and self-evaluating EdTech. 82% of government decision-makers reported having no doubts about how to use the index. A significant number of government decision-makers reported a change in their perception about EdTech quality after training, attributing it to exposure to the Pedagogical Alignment dimension. A government decision maker said, *"I used to focus only on content delivery, but after training I came to know about various pedagogical aspects, which imparts an important role on learners ability."* The government decision makers also said that they wish to use the framework to select EdTech products to enhance their classroom teaching. The successful completion of several large-scale procurements for diverse purposes can be seen as a validation of the adaptability of the Tulna framework.

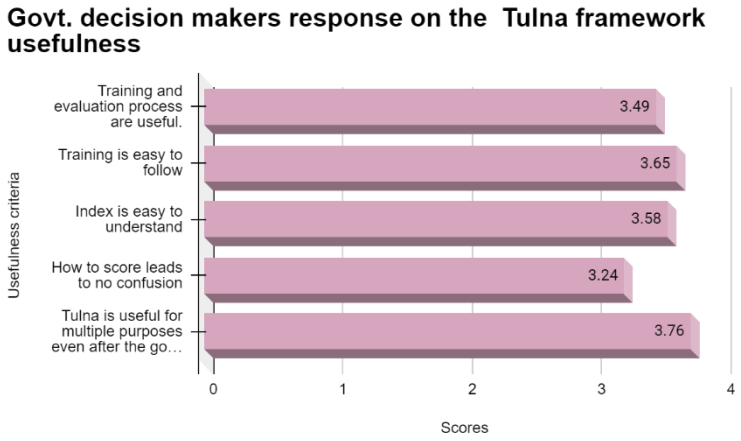

Figure 3. Government decision makers' perception regarding the usefulness of Tulna framework on 4-point Likert Scale (N=45)

5.2 EdTech Entreprenuers

EdTech Hub launched a course to empower EdTech entrepreneurs to integrate evidence-based practices into their product development process. The course instructors approached the Tulna team to develop a framework for entrepreneurs focused on product design. Prior to designing the framework, the Tulna team conducted online meetings and maintained email correspondence with the organizers of the course to understand the entrepreneurs' needs. The entrepreneurs' needs included training to be done in a short time frame and an index that is applicable for self-evaluating their minimum viable product (MVP). Based on their needs, the framework was customized so that it was user-friendly, capable of assessing the MVP and adaptable for use in a limited timeframe. For instance, an organizer said, *"Based on our tight development timelines for the entrepreneurs, it would be best for us to enter into discussions around how to integrate the framework more comprehensively."*

The resources of the framework were customized according to the entrepreneurs' needs, namely, the *Index, Training* and *Toolkits*. An Abridged View of the Index was created with shortened criteria descriptors in the form of indicators to evaluate their MVP. Entrepreneurs could quickly tick whether their product design satisfied the indicators on a 3-point scale. A column was provided to note their rationale for the score so that the entrepreneurs could receive feedback about their self-evaluation of their MVPs. Training included documents that consist of simple examples, which were delivered in 1.5 hour long workshops to accommodate time constraints. The Toolkit included a preamble on how to use the Abridged View of the index to self-evaluate their MVP in two steps: i) Description of their

MVP stage and ii) Product evaluation. Entrepreneurs were guided through this two-step self-evaluation process, ensuring their MVPs were comprehensively reviewed.

A "Train the Trainer" model was employed where 4-6 expert entrepreneurs, who played the role of coaches, were trained per session. The Tulna team conducted a total of three capacity-building sessions. Once the coaches were trained on the customized framework for entrepreneurs, they in turn trained other entrepreneurs. Some coaches trained multiple cohorts, which enabled scalability of the training model. Thereafter, a feedback form about the training sessions was circulated amongst the entrepreneurs. Out of 25 entrepreneurs, 7 filled out a detailed feedback form and 18 rated their products with a rationale for their scores in the scoresheet. Analysis of the scoresheets revealed that 79.9% of the criteria were scored by the entrepreneurs. It was evident from the rationale provided for their scores that they were able to apply the reviewer guidelines for self-evaluation of their product. It was found that a majority of the entrepreneurs agreed that the framework positively shifted their perception of product quality following the use of the customized Tulna framework. Moreover, entrepreneurs perceived that the customized Tulna framework was useful. Entrepreneurs responded based on the six usefulness criteria (Figure 4), where consistent and high ratings across the various criteria were seen. This underscores that the customized framework was beneficial for the self-evaluation of entrepreneurs' EdTech products.

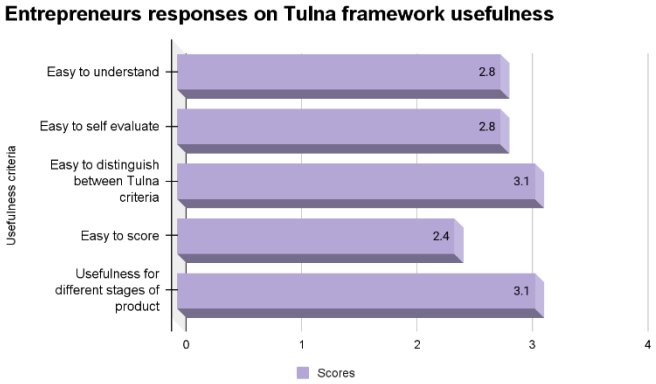

Figure 4. Entrepreneurs' perception of usefulness of Tulna framework on 4-pt Likert Scale (N=7)

5.3 Teachers and Parents

The EdTech Tulna team created an *Evaluation Center* on the EdTech Tulna website as a public good. This is intended for teachers and parents to be able to select among an array of EdTech products that best fit their requirements in terms of subjects, grades, language of instruction, usecases etc. The Evaluation Center consists of two features: 1) Browse Catalogue of Evaluations and 2) Compare Evaluations as shown in Figure 5. The catalogue of evaluations consists of a repository of over 50 detailed evaluation reports of EdTech products. These features allow users to gain an in-depth understanding of the rating of a particular EdTech product under consideration. The compare evaluations feature allows a user to analyze the relative strengths and limitations of two or more EdTech products. More details on the https://www.edtechtulna.org/evaluation-centre-catalogue.

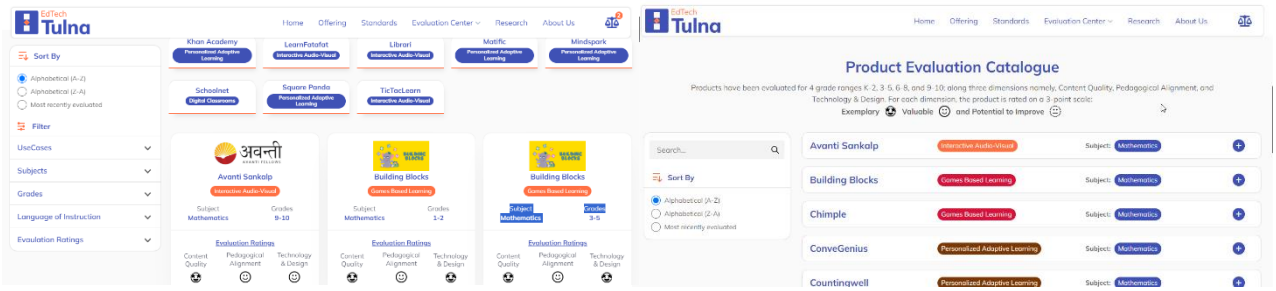

Figure 5. Evaluation center two features i. Compare evaluations and ii. catalogue of evaluation

During the framework design, the needs of teachers and parents were analyzed and their perspectives were built into the framework to cater to their needs. Thereby, we hypothesize that the retail users would find the Evaluation Centre resource of the Tulna framework useful for their respective needs. We are currently designing a study, which aims to assess the usefulness and usability of the Evaluation Center for parents and teachers in selecting EdTech products. As a part of the mixed methods study design, we plan to conduct interviews and surveys with both parents and teachers. We are also in the process of gathering analytics from the EdTech Tulna website with respect to the total numbers, usage statistics and so on of the users.

6. Discussion and Conclusion

The Tulna framework is designed by a RPP that supports decision making regarding EdTech quality by providing customizable resources to cater to diverse stakeholders' needs. This is a systemic effort to design quality standards that contribute towards creating a healthy ecosystem of EdTech supply and demand (Omidyar Network, 2019). The framework caters to multiple needs including time constraints, ease of use, a shortened index, among others. The findings are consistent with existing research on stakeholders use of EdTech frameworks, wherein stakeholders' perceived ease of use and usability (Downey et al., 2007) in a short timeframe and accessibility are pertinent stakeholder needs (Kemp et al., 2024). The resources of the framework were also customized for multiple purposes of the stakeholders, which are selection, evaluation, and self-evaluation. Our findings show that these resources are useful for meeting the varied needs of diverse stakeholders, enabling them to make informed decisions about EdTech quality.

Moreover, the findings from our engagement with diverse stakeholders highlight lessons that address the gap that exists in the understanding of an RPP's dynamics (Coburn & Penuel, 2016). Firstly, to cater to diverse stakeholders' needs, it is pertinent to not only interact directly as some stakeholders may not be able to articulate their own needs. It is also essential to make observations and look at records of information such as the EdTech entrepreneur course documents to have an in-depth understanding of their needs (Mayers, 2005). Secondly, it is vital to have a partner like CSF, who facilitates connections between the research group and stakeholders, which creates strong communication pathways to ensure that there is mutual learning (Farrell, Harrison, & Coburn, 2019). The research group acquires an understanding about partnerships with diverse stakeholders and the on-ground challenges and needs, while the different stakeholders gain an understanding of how to make decisions on adopting quality EdTech. Thirdly, design scaffolds that are stakeholder-centric, which support each of the stakeholders' needs and purposes for decision-making regarding quality EdTech (Government Social Research (2022). Fourthly, partners must be open to making compromises during implementation in order to navigate the tensions that arise during co-design (Severance et al., 2014) such as changing the language used in the index, scoring format, among others.

This paper offers detailed insights into the co-design process of the Tulna framework for researchers engaged in RPPs. Moreover, stakeholders can use the resources, including the index, training, and toolkits, to make informed decisions regarding the quality of EdTech.

The study has a few limitations. It does not consider other types of stakeholders beyond those encountered such as students, head of institutions, among others. Only three potential purposes for using the framework were identified. There might be additional purposes for which the Tulna framework could be utilized such as scalability and sustainability. Furthermore, to improve the use of the framework, the RPP did not co-design the resources in an iterative manner.

While this paper assists diverse stakeholders in low-middle-income countries (LMICs), similar exercises can be replicated in other countries to facilitate decision-making regarding EdTech. Others can attempt an RPP for higher education EdTech adoption. In future work, we plan to assess the impact of the use of the Tulna Framework for diverse stakeholders like conducting a study with parents on the use of the evaluation center of the Tulna website. This includes defining success metrics such as student learning outcomes, etc. Finally, we will

implement iterative refinement of the framework based on stakeholders' feedback and evolving needs to enhance its applicability and impact.

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