



Clear evidence, better decisions, more learning.

A Case for a Systems Approach to EdTech

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THE WORLD BANK



UKaid
from the British people

EdTech Hub research focus

Technology to maximize Girls' education & learning outcomes

Technology to promote school participation

Technology to support personalized learning and teaching at the learner's level.

Technology to enhance teacher effectiveness

Technology to advance data use and decision making in education

Outline

1. Complexity of EdTech
 2. Systems thinking
 - Application to research
 3. Mapping the EdTech network
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EdTech is complex

1. High context dependency
 - CAL programs have differential impact (math/language, student quartile etc.)
2. Complex causal pathways
 - Access failed to improve outcomes (gender, socioeconomic backgrounds, integration of tech etc.)
3. Scale and sustainability challenges
 - Complex set of factors impacting scale and sustainability (government/market, policy, ecosystem etc.)

Conventional vs. Systems thinking

Conventional Thinking

The connection between problems and their causes is obvious and easy to trace.

Others, either within or outside our organization, are to blame for our problems and must be the ones to change.

A policy designed to achieve short-term success will also assure long-term success.

In order to optimise the whole, we must optimise the parts.

Many independent initiatives should be aggressively tackled simultaneously.

Systems Thinking

The **relationship** between problems and their causes is **indirect and not obvious**.

System actors have significant control or influence in solving them through changing our behaviour.

Most quick fixes have **unintended consequences**: they make no difference or make matters worse in the long run.

In order to optimise the whole we **must improve relationships** among the parts.

Only a **few key coordinated changes** sustained over time will produce large systems change.

Systems approaches provide new tools and insights for research

- Allow for the structuring of many variables into meaningful patterns
 - Enable the observation of interactions and patterns not necessarily visible using linear approaches
 - Add a repertoire of mathematical tools such as game theory, linear programming and matrix theory to traditional research methods (Stowe, 1973)
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Applying systems approaches to EdTech research

- **Redefine research questions**
 - What governance structures do we need to create to improve data use in education? would become: How can we enhance and utilise the structures, resources, and processes already present to improve the equity and effectiveness of education?
 - **Redesign research methods**
 - Causal Loop Diagrams, Social Network Mapping
 - **Additional analytical methods**
 - Game theory, Matrix theory etc.
 - **Possible systems theories for EdTech**
 - General Systems Theory (Bertalanffy, 1969)
 - Ecological Systems Theory (Bronfenbrenner, 1977)
 - Complexity Theory (Mason, 2008)
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Limitations of EdTech frameworks

- Linear approach
- Not all take into account context
- Very specific purpose
- Limited focus (macro/meso/micro)
 - Macro: SABER-ICT, UNESCO
 - Meso: Holistic Integration Framework, ICT4E
 - Micro: TPACK
 - Multi-level: Omidyar

Mapping the EdTech network: Methodology

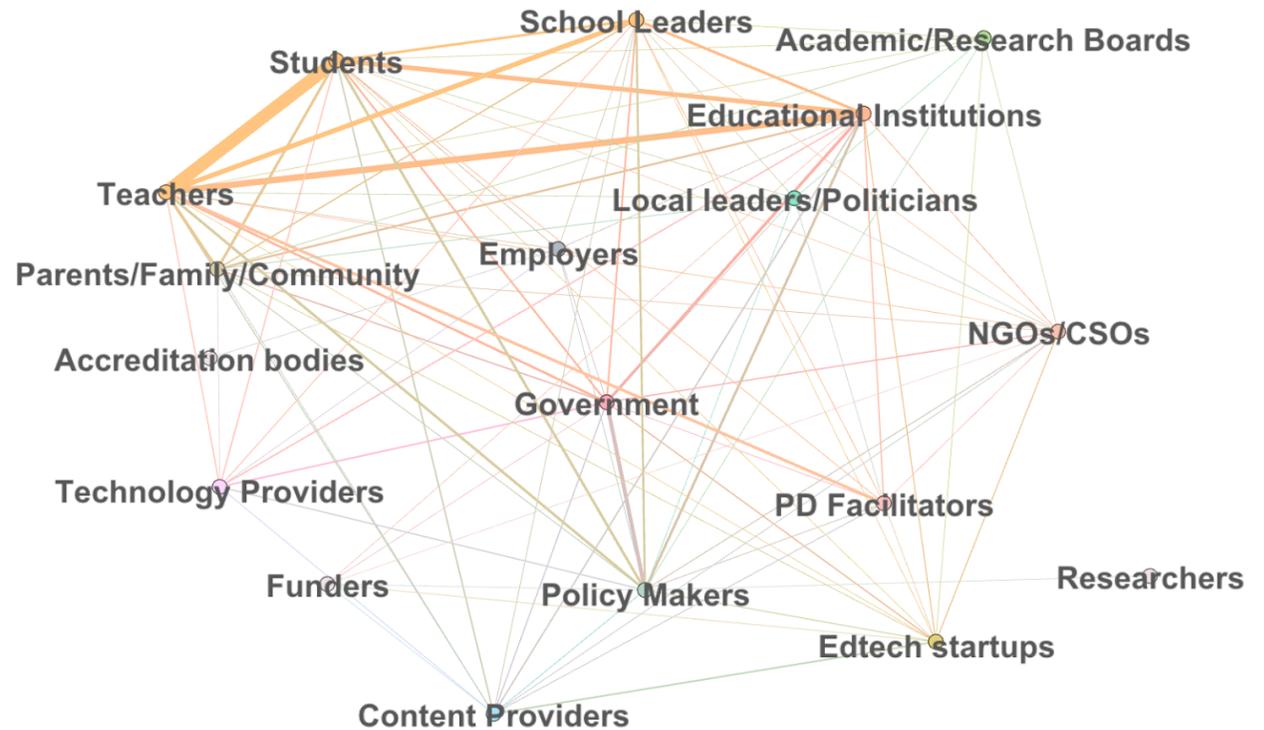
1. Literature review to identify 17 EdTech frameworks
 2. Review of education stakeholder literature
 3. Codebooks of stakeholder characteristics and interactions developed from literature and expert inputs
 4. Coded EdTech frameworks using codebooks
 5. Generated code co-occurrence matrix
 6. Created knowledge graph of EdTech stakeholders
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Mapping the EdTech network: network metrics

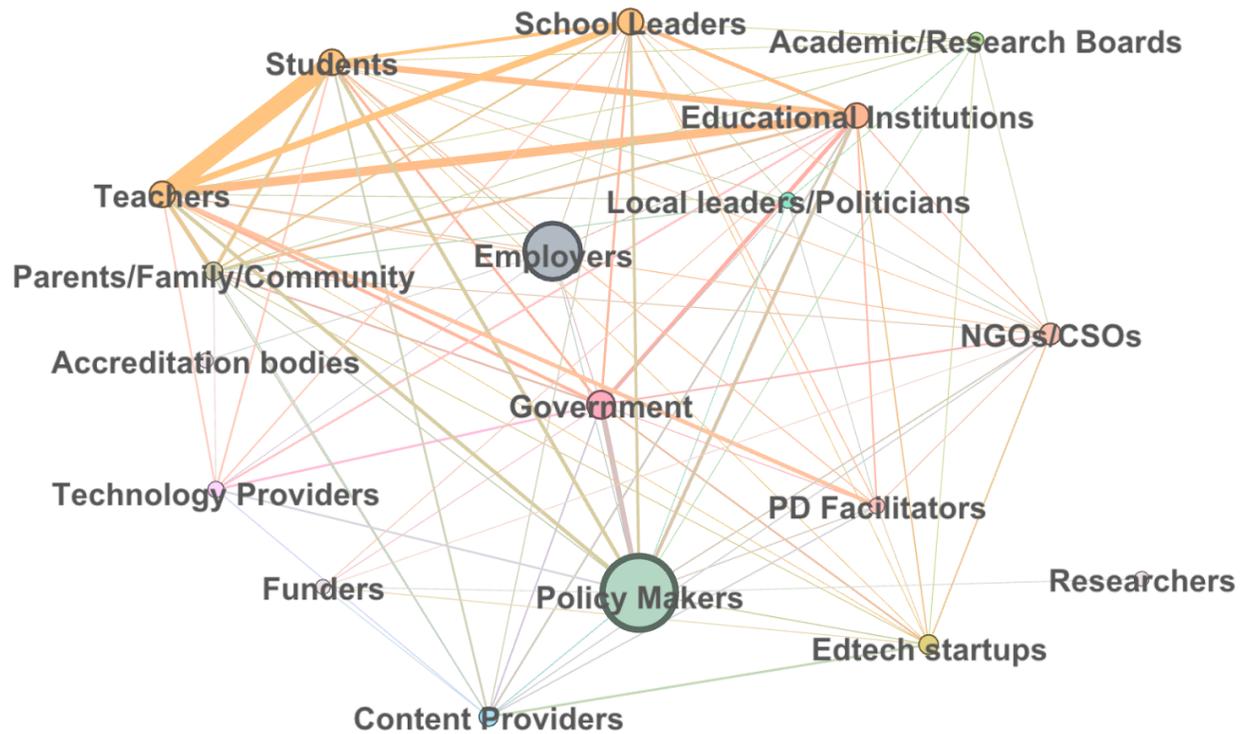
Network Metrics	Number
Nodes (Stakeholder)	18
Edges (Number of interactions)	93
Graph Density	0.60
Maximum Distance (Diameter)	3
Average Distance	1.45
EdTech Frameworks Analyzed	17

Mapping the EdTech network: network density and diameter

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Mapping the EdTech network: betweenness centrality



Mapping the EdTech network: summary

- High interconnectedness
 - Central nodes
 - Policymakers, government
 - School leaders, teachers, students
 - Influential nodes
 - Policymakers, employers
 - Accreditation bodies!
 - Limitations
 - 1 mode network
 - Theoretical
 - Needs validation
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