Education as Articulation in International Development

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ABSTRACT

International development projects attempting technological interventions often lack awareness and insight of the cultural needs in the community in which they are working. This paper aims to assess rhetorical methods of articulation used by developers and create a model for predicting project outcomes. A coding evaluation system was developed to analyze effectiveness of intervention projects and inform successful methods for future projects. Inappropriate contextualization of a community and lack of an educational program can inhibit technology transfer and cause failure of development projects.

TABLE OF CONTENTS

TABLE OF FIGURES

TABLE OF TABLES

INTRODUCTION

The Fallacy of "Sustainable Development"

"Sustainable development" has become a buzzword in international development communities and popular culture. It's a phrase that connects development efforts to the common person. It gives investors confidence that what they are investing in is "good" and will have a lasting impact. But it's a loaded phrase. What does "sustainable" really mean? What is a sustainable development project? It's a hollow word that was fabricated to make projects sound more compelling; like they're a worthy cause.

"Sustainability" is often found married to the idea of social justice: a project will eradicate marginalization, produce economic prosperity, and provide opportunity to the poor communities in which it has been decided that they need *our* help. There are thousands of development projects that are grounded in producing, from a Western lens, a positive change in the lives of the less fortunate. But projects that present themselves as revolutionary or impactful don't often gain traction and quickly fail due to lack of adoption or fall apart when infrastructure maintenance is required.

The greatest focus of this paper is on technology-centric development projects. Often the word sustainable in these projects refers to the duration or resiliency of the project. With so many technology-centric projects that fail, it's hard to classify any of them as sustainable. The factors of uptake and project duration, funding, and education programs all play into the success.

This paper was written with the intention of examining development projects that have failed and succeeded and find the critical point or process that must be present to create a project that is lasting, or so to say, "sustainable". Before doing so, we want to remove the word "sustainable" from our discourse. Any further uses of the word will be ironic; there's no clear definition. It's a fallacy created by Western ideas of international development in an attempt to promote projects. But it's hard to re-define something that's so well founded and so intrinsically attached to international development, and that re-definition of the term that creates a deeper understanding.

Institutions that impose development gauge project success based on whether or not a project can be stamped as "sustainable". This mindset is limiting when considering the various contexts that contribute to project success or failure. While examining various successful and failed international development projects, we found that a thorough understanding of historical, religious, political, social, and environmental contexts was necessary in achieving project success. A transdisciplinary approach to international development leads to larger awareness of a community's constraints in implementing a product, whether it be an idea or piece of technology. Constraints are not necessarily defined as a community's ability to understand a development project, but rather to understand and instill a sense of desire for the project and an innate accountability for the project's success. Contextualizing a singular community, rather than overgeneralizing certain regions of the world, also harbors responsibility in community members to feel invested in the trajectory of a project.

Our research indicated that the presence of an educational component to international development acts as a method by which community members in developing regions can articulate their desire for the project or product being implemented. Educational components in international development can consist of but are not limited to: classes that local community members can attend; community-wide

demonstrations put on by the implementing institution; and opportunities for community members to partake in the implementation and maintenance of the project, and positions of authority to be held accountable for the future of the project. These various methods and outlets for education instill a sense of responsibility and ownership in community members to not only learn about the system or project being implemented, but also maintain the system and view it as a genuine improvement to their community.

BACKGROUND

Modernized Development

U.S. President Harry Truman first introduced the present-day vision of development in his 1949 inaugural address (Black, 2002). Within Truman's address was a call to share new industrial and scientific achievements with less-privileged regions. At its earliest, the term "development" incorporated a kind of dichotomizing, a dimension of "othering" that created poles or ideological camps: the term "developed" was contrasted with "underdeveloped," or sometimes "undeveloped" (Smallman, 2015). Since then, the verbiage changed to discuss "developed" versus "less developed." In each of these cases, the positive anchor "developed" was always used in contrast with its opposite; in other words, the notions of undeveloped, underdeveloped, and less developed could only exist in relationship to the developed.

Later on, dichotomies became less transparent, such as in the terms of "First World" and "Third World". The invisibility of countries behind the Iron Curtain, and the so-called Second World countries, was a product of the West's relationship with these countries following World War II. Eventually, the weaknesses in the bipolar framework caused us to create a Fourth World category. In the early 1970s, West German chancellor Willy Brandt proposed the terms "Global North" and "Global South", although it is somewhat controversial among cartographers that Australia and New Zealand are part of the Global North. We have yet to find expressive yet neutral terms to describe "those who have" and "those who have less." In the same way, we have been unable to find ways to characterize certain areas that do not force a comparison with other areas. In Hans Rosling's much cited TED talk, he explores the importance of using actual data to move beyond dichotomies, stating: "We cannot look upon the world as divided" (Rosling, 2009). As he examines interactions among nations due to improvements in infrastructure, he affirms the importance of not overgeneralizing. In breaking out data sets by year and country, he establishes parallels between nations once classified on other sides of the "developed"/"developing" divide: The United States, China, and Mexico. He also cautions against overgeneralizing: with respect to AIDS and the continent of Africa, he states: "Don't make it Africa. Don't make it a race issue. Make it a local issue. And do prevention at each place." (Rosling, 2009).

Theories of Development

For more than half a century, various scholars have searched for necessary and sufficient measures of development to create a type of index, while others have criticized the inflexibility of such an approach in accommodating contexts. The initial measures chosen were tied to economic indicators: national gross domestic product (GDP) and per capital income. Later measures have included literacy rates, maternal and infant death rates, and life expectancy (Smallman, 2015). Certain scholars have pushed practitioners hard to establish measures that are more holistic and include the actual quality of life.

World War II and the rapid industrialization that followed it shaped how early economists framed the development dilemma (Smallman, 2015). The issues that scholars and policy makers saw as important ranged from identifying deep-seated roots of economic and political development to linking these roots to social change, self-governance, and the degree to which governments need to craft individual and development opportunities for all their citizens. Several theories of development emerged from these dominant ideas throughout the 20th century.

Modernization Theory

Modernization theory—also known as modernity theory—was developed in the early 20th century by Walter Rostow (Smallman, 2015). Rostow proposed a now-classic model of economic growth in which a society moves through five distinct stages: 1) traditional society; 2) preconditions for takeoff; 3) takeoff; 4) drive to maturity; and 5) age of high mass consumption. His description of how a nation-state becomes modern was first anchored in economics (Smallman, 2015). However, Western political scientists, sociologists, and education policy adapted it to their own fields. Modernization theory is a neo-evolutionary theory in that it supposes that all nation-states will follow through from one stage to the next in a linear fashion. It is a somewhat inflexible model that cannot be adjusted for particular contexts. Rostow's five-stage theory was clearly tied to an assumption that "West was best" (Bryant & White, 1982).

Dependency Theory

Dependency theory was developed as a direct rejoinder to modernization theory. A group of anthropologists in Latin America redefined another set of theories they had been working on for decades, but it was until the early 1980s that their works on dependency was translated into English (Smallman, 2015). For the dependency theorists, a dependency on the West—and in particular on "core" countries—keeps nations from developing to their true potential. These scholars termed developing nations "periphery" countries, which provide raw goods and services to their core partners but remain in a state of dependency, and most often, poverty (Smallman, 2015). The terms "core" and "periphery" are replaced by some dependency theorists by "metropolitan" and "satellite" (Bryant & White, 1982). External factors can be multinational corporations, as well as development agents like the World Bank, the International Monetary Fund (IMF), and even international commodity markets.

Infrastructure and other internal elements were rarely identified as items that prevented development. Within the dependency-theory model, educational systems based on Western, capitalist models fostered continuation of a status quo in which elites in the periphery countries carried out the management functions of companies in the host countries (Bryant & White, 1982). The language of dependency theorists often reflects a focus on class and strong criticism of capitalism. Dependency theorists do not believe that assistance can only come from outside the country. They find that dependence on external, powerful nations keeps countries from truly developing. They are supportive of nationalizing energy and mineral-exploration companies.

World-Systems Theory

Immanuel Wallerstein is the chief architect of the world-systems theory. Most of his work occurred between 1974 and 1976 (Smallman, 2015). World-Systems theory focuses on the nature of inequality but does not use the nation-state as the primary focus of control; nor does it hold up highly industrialized nations as markers of development. This theory outlines the role of labor movements and social democratic movements in redressing inequality. Wallerstein's theory was characterized as "a direct attack against Modernization theory" (Chirot & Hall, 1982). World-systems theorists sees it as a powerful theory that can be used to compare development as it occurs in different places (Van Rossem, 1996). Many scholars characterize world-systems theory as a subset of dependency theory, but others emphasize the depth of its links to Marxist economists. What is perhaps most significant about world-systems theory is that current political, economic, and social researchers have been able

to adapt many of its tenets to contemporary analysis—both quantitative and qualitative—and avoid many of the commonly denounced weaknesses of dependency theory.

Present Model

In summary, the theories of development that have been proposed so far have flaws that prevent them all - even the best-formulated ones - from performing as desired. There have been dominant development paradigms over the years, but no individual theory has yet found a corner on the truth. All development strategies are linked to their ideological underpinnings. Modernization theory presumes that all nations must develop in the same manner. Dependency theory presumes that the root causes of underdevelopment are primarily brought about by external forces and that most private fiscal initiatives are problematic. World-systems theory presumes that core countries are dominant capitalist countries that exploit peripheral countries for labor and raw materials. Sustainable development has not yet emerged from any of these theories(Smallman, 2015).

Development Actors

Development actors are operational at local, district, national, international, and transnational (global) levels. At each of these levels, actors can be from the public (government sector), private (business) sector or from the civil sector (ordinary citizens). It is common to refer to the different groups of actors as stakeholders and for interactions between them to be called multi-stakeholder meetings. These offer huge challenges in terms of communication and consensus building. Donors include bilateral and multilateral agents. Bilateral agents are, for example, organizations like USAID. Multilater agencies would include the World Bank, the International Monetary Fund, and the United Nations. These actors provide economic, social, and political development in developing countries.

The Intent of Sustainability

Though a poor word for describing development projects, "sustainability" is used to describe a project with a connotation of durable, societally beneficial, or environmentally-friendly practices. The Oxford English Dictionary defines sustainability as "the property of being sustainable" and defines sustainable as "to be capable of enduring" (Oxford, 2018). Its most generally accepted definition is to "meet the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations, 1987).

Prior to the unintended consequences associated with the overuse of the term, sustainability was meant to refer to the responsibility for our resource and energy consumption, for social development, for the health of our economy, and to protect our vital biosphere. Sustainability has become a very broad term. On one of the spectrum it is used to describe specific ecological processes. On the other, it refers to an organization's values-based approach or goal. Sustainability suffers from being too elastic and it lacks clarity.

One solution is to first define contextually what is meant by sustainability (environmental, economic, humanitarian, health, etc) but organizations often lack this initial framework. Many use it as a catch-all synonym for corporate social responsibility. Others use it consistently, even with the same communications. However, organizations might succeed in defining this term if they link sustainability with ideas or concepts that have clearer, stronger meaning. This requires being diligent across various

communication methods and must be consistently repeated and reinforced in the hope that the proper context will be established.

United Nations Sustainable Development Goals

One of the now most prominent users of the word "sustainability" is the United Nations. On the 25th of September, 2015, countries in the United Nations adopted a set of "Sustainable Development Goals" with targets that have been set to be achieved over the next fifteen years. These goals aim to end poverty, protect the planet, and ensure prosperity for all as part of a new sustainable development agenda.

Figure 1: United Nations Sustainable Development Goals (un.org)

The UN resolution, adopted 25 September 2015 is entitled *Transforming our world: the 2030 Agenda for Sustainable Development*. It begins:

> *This Agenda is a plan of action for people, planet and prosperity. It also seeks to strengthen universal peace in larger freedom. We recognize that eradicating poverty in all its forms and dimensions, including extreme poverty, is the greatest global challenge and an indispensable requirement for sustainable development. (United Nations)*

The 17 goals are coupled with 169 targets which, "demonstrate the scale and ambition of [the] new universal Agenda" (United Nations).

The specific objectives intended to be achieved by each goal are further outlined in Table 1.

Number	Objective
Goal 1	End Poverty in all its forms everywhere
Goal 2	End hunger, achieve food security and improved nutrition and promote sustainable agriculture.
Goal 3	Ensure healthy lives and promote well-being for all at all ages
Goal 4	Ensure inclusive and quality education for all and promote lifelong learning
Goal 5	Achieve gender equality and empower all women and girls
Goal 6	Ensure access to water and sanitation for all
Goal 7	Ensure access to affordable, reliable and modern energy for all
Goal 8	Promote inclusive and sustainable growth, employment and decent work for all
Goal 9	Build resilient infrastructure, promote sustainable industrialization and foster innovation
Goal 10	Reduce inequality within and among countries
Goal 11	Make cities inclusive, safe, resilient and sustainable
Goal 12	Ensure sustainable consumption and production patterns
Goal 13	Take urgent action to combat climate change and its impacts
Goal 14	Conserve and sustainably use the oceans, seas and marine resources
Goal 15	Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss
Goal 16	Promote just, peaceful, and inclusive societies
Goal 17	Revitalize the global partnership for sustainable development

Table 1: UN Sustainable Development Goals

Of these goals, the only one that is, by definition, sustainable is Goal 7. Affordable, reliable, sustainable, and modern energy is an economic development that does not deplete natural resources. Goals 11 through 15 act to conserve natural resources and prevent further degradation of the environment, which is closely tied to environmental sustainability. The rest of the goals are "sustainable". They act to diminish poverty and hunger, increase access to education, promote equality, and provide access to sanitation. None of these are bad goals that shouldn't be pursued, but they also aren't "sustainable". They're goals that are promoting social justice that have been lumped into an umbrella term.

The sustainability goals sound actionable, they sound important. End hunger, end poverty, ensure, ensure, ensure… The verb heavy phrases emphatically state the changes that are intended over the next fifteen years. But by what means will they be achieved? And are they anything more than hollow, buzzword-filled phrases that will incite a new wave of "sustainable" development projects?

ICT4D

Information and Communication Technologies for Development (ICT4D) projects seek to apply a technologically grounded solution to a development problem. Richard Heeks proposes that there have been two phases of ICT4D: 1.0 and 2.0. ICT4D 1.0 projects had short timescales and a pressure to show delivery, so development actors "looked around for a quick, off-the-shelf solution that could be replicated in poor communities in developing countries" (Heeks, 2009). This movement created the archetype of the "telecenter", a room or building with internet-connected PCs with the intent of delivering information, communication, and services to poor communities (Heeks, 2009). ICT4D has "sought to surf each new wave of 'technovelty'", an invention-down approach, rather than a use-up

approach of understanding existing technologies within communities (Heeks, 2009). The outcome of ICT4D 1.0 Heeks sums up with 3 words, "failure, restriction, and anecdote."

The failures of these initial projects led to the development of ICT4D 2.0. Less emphasis is placed on the technology that *might* be used and more placed on what *is* used. There is less emphasis on innovation, and more emphasis on application. And less emphasis is placed on piloting and sustaining new applications, and more emphasis on assessing and scaling existing applications (Heeks, 2009).

What was greatly lacking in ICT4D 1.0 was a purpose within communities. As a development method, 1.0 was very much a top-down endeavor. A project's implementation would not deviate from initial plans and there was an inability to build appropriate knowledge that would help the project. In other words, developers were inflexible in their approaches, wanting to only implement their technology, and didn't bother to develop a cultural understanding of the community in which they were working. ICT development only works when "a combination of private firms' search for profit plus the poor's search for value . . . make it happen" (Heeks, 2009). A force-feeding of technology in an inappropriate manner will "only lead to a messy regurgitation" (Heeks, 2009).

Technology Transfer by Assimilation and Articulation

Information and Communication Technology for Development (ICT4D) projects, which will hereby be referred to as ICTs, typically have two modes of intervention: technology-centric and community-centric. In Dodson, et. al's *Considering Failure: Eight Years of ITID Research*, a survey of forty ICT projects was conducted. Of the forty surveyed, nineteen were technology-centric, thirteen were community-centric, and eight a hybrid of the two (Dodson, Sterling, & Bennett, 2012).

But technology-centric projects fail to address the human and cultural aspects of international development projects, often resulting in failure – even for technologies that would greatly benefit the community. Amadei et. al make the claim that "engineers are not usually involved in development projects that specifically focus on sustainable community development," and "non-technical people often address many technical problems related to development" (Amadei, Sandekian, & Thomas, 2009). Because technological interventions are being implemented by those who know very little about the community and related policy, or technology is being implemented by those who know very little about the technology, there is a disconnect between what the community wants versus what the community needs.

Even technological interventions that may prove to be beneficial to the community in the long-term may fail because of a lack of uptake. An example of this phenomena in the "developed world" provided by Amadei et. al is flossing"

> *"dentists have long advocated that people floss their teeth several times a day. Yet even though people know the reasons to floss their teeth, many of them do not follow the recommendation. Instead, they knowingly run the risk of significantly more expensive and painful interventions later in life. One main reason for this is that many people simply can't be bothered to take that little bit of extra time every day to do something so mundane. In [this case], education and resources are not necessarily sufficient to ensure compliance with a public health recommendation when the action would impose a burden on the individual." (Amadei et al., 2009)*

They further suggest that education alone will not ensure successful adoption of new systems. "To be truly sustainable, communities must take ownership of the project and resulting systems. Without self-motivated behavior changes, implemented technologies will be ineffective" (Amadei et al., 2009).

Adoption of technology will only occur when communities are self-motivated to take control of newly implemented systems, which occurs when the technology has been deemed important or beneficial enough that it takes on a higher meaning. We will refer to this type of adoption as "articulation". In Bruno Latour's *The Modern Cult of the Factish Gods*, he makes the statement that, "only human actions give voice and power to objects . . ." (Latour, 2010). In an earlier book, *ARAMIS*, Latour again critiques the incorrect assumption that technology by itself will drive change. ARAMIS, a failed novel train system in France, which was far ahead of its time and could have revolutionized public transport, was never fully realized. Even though the concept was worthy and received significant investments for its development, its necessity was never articulated. No one wanted the train system enough; existing trains were sufficient: why change what isn't broken? Latour concludes, "Don't ask ARAMIS, don't ask a project, to do something you as individuals and corporate bodies find yourselves incapable of accomplishing" (Latour, 1996).

Another common reason for failure of ICT projects is that the implementer does not try to assimilate themselves into the culture. ICT developers insert themselves into a community that "needs their help" with a technology that will "change their lives for the better".

James Blish in his omnibus of four science-fiction novels, *Cities in Flight*, creates a scene in which a highly technically advanced community arrives at a planet in the far reaches of an undeveloped galaxy. The planet's citizens, in the midst of a civil war between themselves, lack any technology beyond rudimentary tools and weapons; but the priests, regarded as the rulers of the planet, have access to some highly developed technologies, but don't provide them directly to the citizens in fear that they will destroy themselves because they don't understand the purpose or danger of some of the tools. For the priests, which in this case can be analogous to international developers, they realize the necessity of following the community rituals:

> *It is only the priesthood which teaches us that it is better to be men than mud-puppies. So, we – the technicians – follow the rituals with great strictness, stupid though some of them are, and consider it a matter of no moment that we ourselves do not believe in the gods. (Blish, 1970)*

What allows the priests to maintain their status and effectively help the struggling communities is their effective assimilation. Though they do not believe in the traditions of the culture, which strongly dictate the actions of the community, the priests have taken the time to understand the role of traditions in the culture and by following the traditions, their ability to articulate the importance of certain technologies is maintained.

Education in International Development

Educational programs in international development are almost synonymous with building schools and providing access to education.

> *"Education serves as a drive for development and the elimination of extreme poverty. Education is transformational for individuals and societies – it creates pathways to better health, economic growth, a sustainable environment, and peaceful, democratic societies." (USAID.gov)*

These sentiments are echoed by many major organizations that are drivers of educational programs in international development. The World Bank's International Development Association, the United Nations Development Programme are two major players; but there are also many small NGOs and organizations with the same goal: Pencils of Promise, buildOn Global, United World Schools, Build Africa… almost countless organizations with the same goal.

Although widely accepted by the international development community, the current theories of development previously mentioned all have shortcomings that prevent them from performing completely as desired. Our research led us to develop our own model for defining successful international development and intervention. This model is somewhat a hybrid of all previously mentioned theories of development (modernization, dependency, and world-systems), but includes the integral component of education. The various mediums and outlets for education instill a sense of responsibility in community members to not only learn about the system or project being implemented, but to maintain the system and view it to genuinely improve their community.

Education has an indispensable role to play in driving more equitable and sustainable development. Part of doing whatever it takes to lift human development so that every person can fulfill their potential and live in dignity is providing access to education. Its power to transform lives has ripple effects over every area of development, making investing in education one of the most effective investments we can make. Incorporating an educational component with all methods of international development is intrinsic to assuring success.

METHODOLOGY

To assess international developments as failures or successes a coding method was developed to analyze project documentation. To begin assessment, literature from international development organizations was collected from their websites. This was typically in the form of an annual report, project overview, or an about statement. In some instances, all three were used to develop an entire picture of the organization or project.

Initial readings of this literature, in combination with literature discussing current development methods, allowed us to determine five variables that were applicable to every development project.

The five variables that were determined to be drivers of success or failure are:

1. A top-down vs. bottom up approach to project implementation?
2. Is uptake of the technology achieved?
3. Was user-input asked for?
4. Was input used to iterate the project?
5. Was the project continued after the developer left?

These variables were all assigned values that could be used to numerically assess their influence on the project. The rationale and values are described below:

Variable 1
A top-down vs. bottom up approach to project implementation has been one of the major changes from Heeks' so-called ICTD 1.0 to ICTD 2.0. Initially, ICTD for development began as "quick, off-the-shelf solution[s] that could be replicated in poor communities in developing countries" (Heeks, 2009). These projects were delivered into developing communities without approaching the community members before project development. With the shift within the ICTD community towards a '2.0' mindset, a greater focus was placed on the needs of the community before implementation. Because this shift from top-down to bottom-up signaled a change within the development community, the first coded element of development reports was the method used. A top-down approach counted as 0, and a bottom-up approach counted as 1.

Variable 2
The uptake or acceptance of a technology within a community is an indicator of how well it has been transferred from developer to user. One of the reasons that projects aren't permanently integrated into a community is because people "simply can't be bothered to take that little bit of extra time every day to do something so mundane" (Amadei et al., 2009). Unless users become individually motivated to use a technology it won't be absorbed an integrated into the community. Proper transference of a technology by the developers can lead to a better rate of permanent uptake. This was measured from project documentation at three levels: if transference was not attempted (0), if uptake was not successful (1), and if uptake was successful (2).

Variable 3
User input is a critical component of not only top-down approaches of development, but also for feedback to improve or modify the project. Because feedback helps improve development and has

had a growing impact on ICTD, user input was a coded project metric. A project with no user input received a 0, projects with inputs received a 1.

Variable 4
Project iteration is a combination of user input and developers working with feedback to improve future implementations or provide modifications to existing programs. In some projects there were no requests for feedback, which received a 0; projects with a request for feedback, but the feedback wasn't used to further the project, which received a 1; and projects where feedback was used to improve future implementations.

Variable 5
Project durability, what is frequently described as 'sustainability' is how long the project lasts after implementation. There were four rankings established for project durability: if a project was not fully established or implemented it received a 0, if a project stopped as soon as the implementer left it received a 1, if a project continued for a short time after the implementer left it received a 2, and if the project has continued without the implementer it received a 3.

The overall coding scheme and point rankings are as follows:

Top Down vs. Bottom Up
- 0- A top-down approach was used
- 1- A bottom-up approach was used

Uptake of Technology
- 0- Uptake by transference was not attempted
- 1- Uptake was not successful
- 2- Uptake was successful

User Input
- 0- User input was not asked for
- 1- User input was asked for

Iteration
- 0- Feedback was not used to improve the project
- 1- Feedback was asked for, but not used to improve the project
- 2- Feedback was used to create a next iteration of the project

Project Resilience and Durability
- 0- Project was not fully implemented
- 1- Project ended when implementer left
- 2- Project continued for some time after implementation, but failed after implementer left
- 3- Project has continued after the implementer left

The initial coding of project documentations was determined to be too coarse, and while it provided a method of classifying projects as failures or successes, it did not allow for development of a predictive model. Through analysis of many projects, it was determined that the most important aspect of project implementation was the existence of an education plan instead of if a project could be classified as resilient or "sustainable". This discovery was used to develop a second iteration of our coding mode.

The second iteration of our model for numerically evaluating international development articles introduced a sixth variable: the existence of an educational programming and a transition plan. This variable (E), rather than being summed with the previous ones served as a multiplier. If an education program existed, E=1; if an education program did not exist, E=0.5.

The equation used to calculate the overall rating score (S) of the analyzed projects is shown below in Equation 1:

$$S = \sum_{i=1}^{5} V_i \times E \qquad E = \begin{cases} 1 \; if \; yes \\ \frac{1}{2} \; if \; no \end{cases}$$

Figure 2: Equation of Calculating Success or Failure Score

RESULTS AND DISCUSSION

After coding each of the selected development projects the threshold for success or failure was determined. A resulting score smaller than 5 constituted a failure, scores greater than 6 constituted success. The results of the numerical coding analysis are shown below in Table 2.

Case Study	(V1)	(V2)	(V3)	(V4)	(V5)	(E)	(S)	Outcome
Women's Empowerment through Poultry Farming	0	1	0	1	2	Yes	4	Failure
Playpump	0	1	0	0	1	No	1	Failure
Delay-Tolerant Technology on Mobile Phones to Support Aid Workers in Africa	0	1	0	2	1	No	2	Failure
Computer Lab	0	1	1	2	2	No	3	Failure
Chirog Kiosks	0	1	0	2	2	No	2.5	Failure
One Laptop Per Child	0	1	0	1	1	No	1.5	Failure
The Ladakh Project	0	2	0	1	3	No	3	Failure
Dar Si Hmad Fog Water Harvesting	1	2	1	2	3	Yes	7	Success
Dar Si Hmad SMS Fog Phone Texting	0	1	1	2	2	Yes	6	Success
Off Grid Electric	0	2	1	2	3	Yes	7	Success
Women's Empowerment for Resilience and Adaptation Against Climate Change	1	2	1	2	3	Yes	7	Success
Maputo Waste Management	1	2	1	1	3	Yes	8	Success
Initiative:eau	0	2	1	2	3	Yes	8	Success
Rural Electrification in Mali	1	2	1	2	3	Yes	9	Success

Table 2: Numerical Coding Outcomes

The findings of this coding system indicate that there is no development project that will succeed without the presence of an education program, however education programs do not guarantee success. This seems a fairly obvious conclusion, but if it's so obvious, why do so many organizations fail to include it in their "sustainable" project?

There are two ICTD projects we have experienced closely: fog water harvesting in rural Morocco and 3D-printed automatic weather stations (3D-PAWS). The difference between the two: the first was an enormous success, the second couldn't even be implemented on a small scale.

Fog water harvesting in rural Morocco is an effort led by a Moroccan NGO, Dar Si Hmad, that has, in coordination with a German engineer and the local communities, revolutionized fog water harvesting to provide local villagers with a steady supply of clean water, complete with a tap in every home. The fog water project has been a huge success and should be examined as a development project that others could be modeled.

The cornerstone of Dar Si Hmad's fog water collection program is not necessarily just the technology of the fog collectors that have been installed, but their education programs that have been coincidentally implemented. Their education program begins with the children of the community in which they work with the Water School. The goal is "not only to foster consciousness and awareness about sustainable water practices, but also to develop a comprehensive understanding of the water economy and how it shapes one's environment." The Water School covers topics of reforestation, septic tanks, environmental toilets, hygiene and sanitation. The ultimate goal is "to empower communities with limited drinking with resources to improve their living conditions" (Dar Si Hmad, 2016).

By starting an engaging scientific education at a young age, Dar Si Hmad can provide children with an understanding of the natural world. In targeting the education to the youngest group in the community, it becomes possible to educate the older groups of the population second-hand. In first giving the children a grasp of science in a way that is educational and culturally appropriate – and uses a hands-on approach – children are able to bring the lessons they have learned back into their home and re-articulate the lessons in a way that is understood by their parents.

Re-articulation becomes the mode of technological transference, and it this case it happens almost on its own. Education starting at the most basic level incites change throughout the community. As with Latour's analysis of ARAMIS, there was only one way that public transportation would have become widely accepted: "you have to get people to see public transportation the way they see their own automobiles, so they'll take public transportation instead of their own cars. It's a matter of mimicry, just like in the jungle" (Latour, 1996). The education provided to the children begins to re-articulate itself when it's brought home. The conversation about what they've done at the Water School becomes part of a normal discourse between the children and parents - in a language register that is familiar to both. It's disguised. And in being disguised, acceptance and transference have become successfully achieved.

On the other end of the spectrum is the 3D Printed Automatic Weather Station (3D-PAWS) program developed by the University Center of Atmospheric Research (UCAR). It is a technological development project designed for data collection but is veiled in social benefit. The goals are to "build capacity to reduce hydrometeorology-related risk in developing countries", "observe and communicate weather and climate information to rural communities", and "develop observation networks to reduce weather related risk". The goals use descriptors of "developing countries", and "rural communities", both parts of the common discourse that surrounds international development. These low cost stations are advertised to be quickly assembled and at a low cost, with the intent of "local agencies tak[ing] ownership in building and maintaining observation networks" (Kucera Ph.D,

2015). That final objective, giving ownership to "rural" and "developing" countries is the goal of all development projects. This is the fallacy of "sustainability" – provide a technology and make the community take ownership. This goal calls for re-articulation, it begs for an education program that allows for technology transference, but the first iteration of 3D-PAWS never achieves it.

The 3D-PAWS program is the purest form of an information and communication technology for development project. The goal was to develop a high-quality weather station that could easily be 3D printed and deployed in developing countries at a low cost. Weather and climate information is important to many socio-economic sectors, public safety, and climatological modeling applications. The 3D-PAWS documentation promised a "very high quality surface weather station that can be manufactured in about a week, costing between $200 and $400" (Kucera, 2017). On attempting to produce a replica of the 3D-PAWS station we found that the claims about timespan and cost – and ease of use – didn't align with the reality. Taking eight weeks and costing nearly $700, the attempt at replication produce a barely-working weather station that produced inconsistent data and was not user-friendly.

The 3D-PAWS program is still very much in a development phase and there haven't been enough iterations to create a working system that can be easily used by an external party. As one of the first few groups to ever attempt to produce one outside of the initial developers, we went into the project with the expectation that we would have a working station in a few days. Our hopes were proved wrong when printing and assembly took over eight weeks, and only half of the sensors worked.

What we identified as the critical failure of the 3D-PAWS program was the poor transference of technology to an external party. If the UCAR documentation couldn't clearly provide instructions of use to two engineers in the same culture, there is no chance 3D-PAWS would experience uptake in different cultures – cultures categorized by either social or religious aspects; or in this case, even cultures defined by different educational backgrounds.

A presumable cause of poor technological transference by the 3D-PAWS program was that its developers were already involved in creating the system. They were the creators, the experts – they know exactly how every component fits together, and to them it's almost second nature. Though their documentation was lengthy, it wasn't necessarily what was needed by a third party to complete assembly. What they assumed was extensive, accurate, and helpful articulation was almost unintelligible to an external assembler. Their culture of assembly failed to mesh with ours; their vocabulary, though the same as ours, had different meanings; and suppositions of our existing knowledge were inaccurate. Transference of 3D-PAWS from UCAR to us is a unique case of failure to articulate within the same culture, within the "West".

Where the Dar Si Hmad technology transference would qualify to Latour as a well re-articulated project that achieved societal uptake, 3D-PAWS fails in the same way that ARAMIS did: researchers and developers asked a project to achieve what they could not. The fundamental concepts were present and well founded, but poor documentation and lack of education made its transference impossible. Further, the cost and time commitment of 3D-PAWS makes it undesirable. For $700 we could have instead purchased an existing weather station and saved ourselves eight weeks of work. And at the end we would have actually collected meteorological data.

While these two projects are incredibly disparate, the critical point of success or failure was education and articulation. Both projects could provide societal benefits, both projects look and feel meaningful,

but only the one that took the effort to ascribe a meaning to its technology within its sphere of influence was successful in accomplishing anything.

An article written by Stephen Fierbaugh for ICTworks titled *The Top 10 ICT4D Project Failures Will Surprise You* is shockingly anticlimactic. His top reason for failure was computer illiteracy. His primary conclusion and recommendation for ICT projects moving forward: "investing in training in basic computer skills in the best ICT risk reduction for development projects" (Fierbaugh, 2017).

When presenting our findings of this project before this paper was finished, a common question asked by poster reviewers was, "you claim educational programs are the key to success, but isn't this a fairly obvious conclusion?" It's an obvious conclusion on reviewing projects retrospectively as an independent third party, but if it's so obvious why do so many ICT4D projects not focus on education before implementation?

Fierbaugh's conclusion wasn't surprising, it was illuminating. Those in the international development community are still technologically centric and avoid cultural assimilation. There are additional cost and time factors associated with education programs but would be a step towards preventing such a high rate of failures. If "just using a computer to read email and communicate was a painful struggle for many . . . project personnel", if "the team had a BGAN satellite modem, but they never turned it on because they had never been trained about it" are "surprising" to ICT developers, then there is no technological failure, there is only a failure to educate (Fierbaugh, 2017).

As Richard Heeks proposed inflexibility in ICT4D projects a source of failure, this conclusion is echoed by Ties Kroezen, an initiator of the NICE Centres project which was intended as a chain of internet cafes in Africa. Kroezen's lesson after the failure of the project was, "if you go there with an idea from here, you will never achieve real ownership there, even if you work with people from there" (Kroezen, 2013).

A high-profile example an inflexible, off-the-shelf solution in ICT4D that failed spectacularly was One Laptop Per Child (OLPC). Though this has been cited and discussed as an enormous failure many times it still presents an opportunity for examining a project that completely avoided education. Mark Warschauer calls the implementation of OLPC a project that failed because of "The Miracle Transformation Falacy [sic]" (Warschauer, 2009). This fallacy is based in "media determinism", which assumes that simply providing media or technology will automatically have an effect no matter the context in which it is deployed (Warschauer, 2009). While simply providing children with laptops incites no positive change, deployment in incredibly poor nations that lack infrastructure creates a greater burden. The need for electricity, bandwidth, and teachers who are skilled at using the technology are all necessary for success.

Again, OLPC shows a lack of education leads to failure, but the problem was two-fold: there was no articulation of importance. What Warschauer calls the "Sesame Street Effect" is an example of how the rich benefitted disproportionately from reforms that were targeted at the poor. Parental or familial support for using the computer as a learning tool led to better outcomes, typically measured by test scores (Warschauer, 2009). Familial involvement and discussion normalizes the technology within context of the culture and society and produces a greater positive benefit than simply giving a child a laptop with no discussed importance.

The ignorance of the importance of education presents itself again in an article titled *This is the Single Biggest Success (or Failure) Factor in ICT4E* (here, E stands for education). Jonathan Nadler finally says it directly, "It is not the technology" (Nadler, 2012). Here a new buzzword other than sustainable is introduced, "the flipped classroom"(Nadler, 2012). Figure 3 shows the new cyclical development model developed from the failed OLPC program.

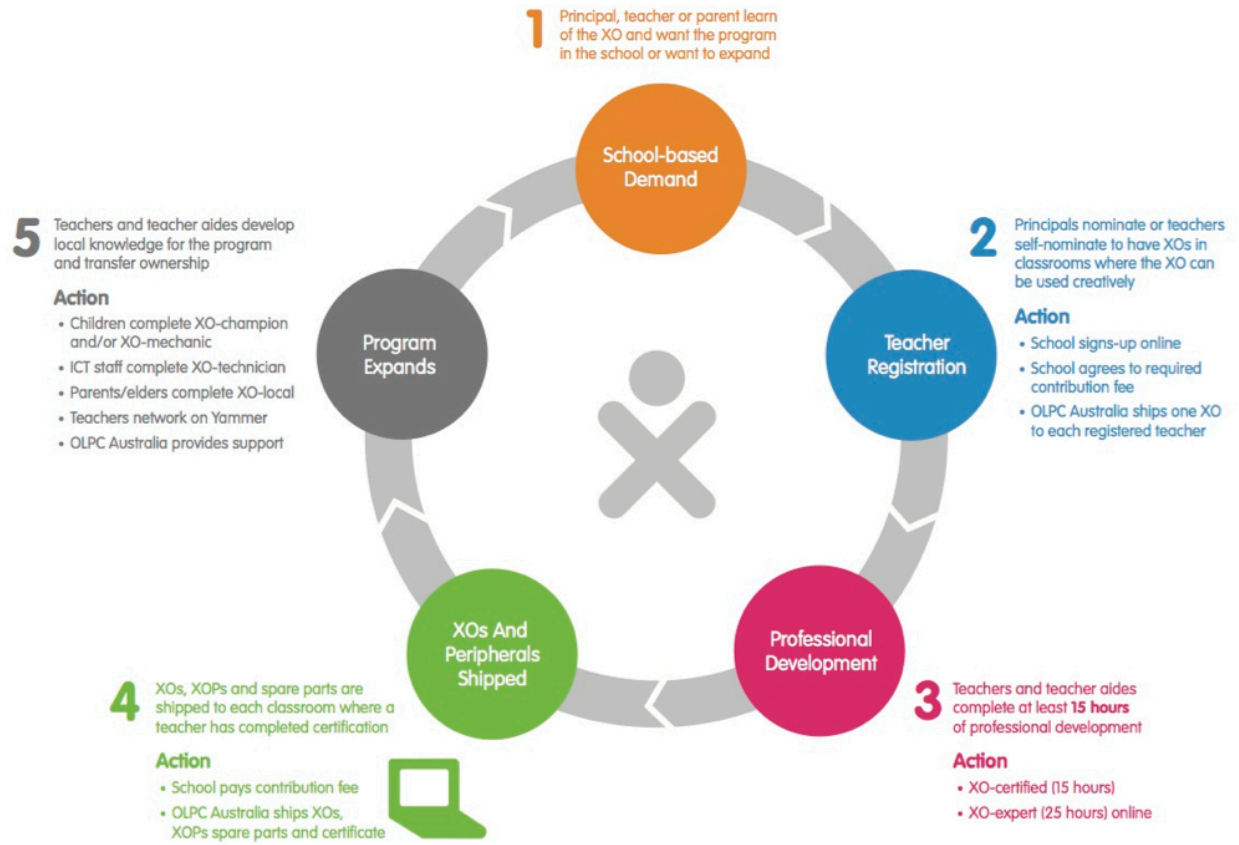

Figure 3: XO Laptop Implementation Cycle (Nadler, 2012).

Instead of delivering laptops directly to students, a desire for implementation is required of the school (1). Schools then must have teachers willing to become registered teachers and develop ways that the XO laptop can be used in the classroom (2). The teachers receive one laptop each and must complete a minimum of 15 hours of professional development training (3). Only once training has been completed, XO laptops are delivered to classrooms with registered teachers (4). With training, teachers develop their own knowledge and take ownership of the program which they can then transfer to students (5). The cycle has been completed and if the school recognizes success and wants the program to expand it can return to phase 1.

Ownership of the technology by education professionals, stemming from a desire to have the XO program implemented creates a community-driven uptake of technology, which is then re-articulated from teachers to the students that will ultimately benefit from the program. No longer is the miracle transformation fallacy for technological development in place, but uptake is created by an importance at the community level.

CONCLUSION

The presence of an educational component to international development acts as a device of articulation by which community members in developing areas can re-articulate the project or technology in a culturally appropriate manner. By assessing international developments as failures or successes, we determined five variables that were applicable to every development project. An iterative process of developing this model led to a sixth evaluation parameter: the existence of an educational program and transition plan. Our findings indicate that there is no development project that will succeed without the presence of an education program, however education programs do not necessarily success. The education programs that incorporate education contribute to overall project success because they articulate a sense of responsibility to community members by learning about the project being implemented, learning skills to maintain the system, and develop an understanding of the project as an overall improvement to community life. The best development projects become something that is taken ownership of by the community resulting in a resilient, durable project.

While examining various successful and failed international development projects, we found that a thorough understanding of historical, religious, political, social, and environmental contexts was necessary to achieve project success. A transdisciplinary approach to international development leads to larger awareness of a community's constraints in implementing a product, whether it be an idea or piece of technology. Constraints are not necessarily defined as a community's ability to understand a development project, but rather to understand and instill a sense of desire for the project and an innate accountability for the project's success. Contextualizing a singular community, rather than overgeneralizing certain regions of the world, also harbors responsibility in community members to feel invested in the trajectory of a project. The project is no longer an off-the-shelf solution to a "problem" that has been developed by a Western culture, but a tailored solution to the community's needs.

Education has an indispensable role to play in driving more equitable and resilient development projects. International development projects have the goal of promoting human development, fulfilling their potential, and creating more dignified standard of living. It is a transformative idea, and when incorporated successfully in tandem with educational programs, development projects have a greater chance of success.

But the development community needs to stop calling these projects "sustainable". This hollow word has no meaning unless it is applied to a project that is literally sustainable (i.e. renewable energy or reforestation). We propose that a development projects that contain an education program, achieves community uptake, and successfully transfers a technology in a way that betters a community should be called a human or community development project. This describes the project for what it is, removes the loaded connotations of the word "sustainability" and places importance on the human dimension of the project rather than the technology itself.

REFERENCES

- Amadei, B., Sandekian, R., & Thomas, E. (2009). A Model for Sustainable Humanitarian Engineering Projects. *Sustainability, 1*, 1087-1105.
- Black, M. (2002). The No-Nonsense Guide to Development.
- Blish, J. (1970). *Cities in Flight*: Avon Books.
- Bryant, C., White, L. (1982). Managing Development in the Third World.
- Chirot, D., Hall, T. (1982). World-Systems Theory. *Annual Review of Sociology.*
- Dar Si Hmad. (2016). Dar Si Hmad. Retrieved from darsihmad.org
- Dodson, L. L., Sterling, S. R., & Bennett, J. K. (2012). Considering Failure: Eight Years of ITID Research. *Proceedings on the Fifth International Conference on Information and Communication Technologies and Development, ICTD '12*, 56-64.
- Fierbaugh, S. (2017). The Top 10 ICT4D Project Failures Will Surprise You.
- Heeks, R. (2009). The ICT4D 2.0 Manifesto: Where Next for ICTs and International Development. *Development and Informatics Group, Working Paper Series*.
- Kroezen, T. (2013). How a Wonderful Business Plan in Africa Failed.
- Kucera Ph.D, P. (2015). 3D Printing - USAID Blog Post. Retrieved from https://www.iepas.ucar.edu/category/mma/3d-printing/
- Latour, B. (1996). *ARAMIS or the Love of Technology* (C. Porter, Trans.). Cambridge, Massachusetts: Harvard University Press.
- Latour, B. (2010). *On the Modern Cult of the Factish Gods* (C. Porter & H. Maclean, Trans.). Durham and London: Duke University Press.
- Nadler, J. (2012). This is the Single Biggest Success (or Failure) Factor in ICT4E.
- Rosling, H. (2009). Let my Dataset Change Your Mindset. *TED Talk.*
- Sustainable. *OED Online*. Oxford University Press, 24 April 2018.
- Smallman, B. (2015). Introduction to International and Global Studies.
- United Nations. Sustainable Development Goals.
- United Nations. (1987) Report of the World Commission on Environment and Development.
- USAID.gov. Education: Education is Transformational.
- Van Rossem, R. (1996). The World-System Paradigm as General Theory of Development: A Cross-Cultural Text. *American Sociological Review.*
- Warschauer, M. (2009). The Miracle Transformation Falacy.