DEVELOPING HUMAN CAPABILITIES:
Open Educational Resources
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EXECUTIVE SUMMARY

In this policy proposal we advocate the application of principles of a social knowledge economy to education in the context of broad changes to the infrastructure and practices that support learning and education in the development of Buen Vivir or Good Living. Beyond conventional notions of learning and education that largely depend upon closed proprietary systems, we examine the value of commons-based learning networks in the context of open knowledge building and open educational resources (OER). Simply put, this policy proposal emphasizes the application of principles of Good Living to the development of human capabilities, including a particular emphasis on active public policies that advance the *public good* in the context of reciprocity and commons-based value creation.

The Introduction to this proposal begins by examining the basic principles of OER, highlighting the role of free access to knowledge as fundamental to the evolution of Ecuadorian society and economy. The cornerstone of the FLOK model is the free and open sharing of knowledge. Its founding philosophy is that technology is most efficiently developed in conditions of openness and collaboration, than in secrecy and/or knowledge hoarding. By democratizing access to knowledge through the use of open licensing, the FLOK approach seeks to empower communities to participate in the production and consumption of knowledge without limitation. In this way, the FLOK model challenges the predominant view that closed hierarchically-organized institutions are the best systems for developing knowledge and innovation. Instead it suggests that open, community models are superior to corporate models in accommodating creativity and delivering innovation.

In Section One, *The Ecuadorian Context*, we contextualize changes to Ecuador's education policies, by framing these changes in terms of the broader global economic system in which the country's social development is now embedded. Building on the need for competitive "human capital", economic policymaking is now increasingly oriented toward augmenting high-skilled labor. It is within this broader global context that Ecuador's government has undertaken major restructuring of the country's educational system.

In Section Two, *Examining the Knowledge Economy*, we introduce the FLOK model as an alternative to proprietary systems of knowledge and learning.

In Section Three, *The Open Knowledge Commons,* we consider new forms of knowledge and learning linked to communities-of-practice and commons-based learning platforms. While traditional Cartesian educational systems require students to spend years learning about a subject, the rise of the Open Knowledge Commons suggest a very different approach to teaching and learning.

In Section Four, *Case Studies*, we illustrate the FLOK model and its features through a series of case studies. We examine two case studies that highlight the principles of an open

1

knowledge commons in the context of peer production.

In Section Five, *Public Policy Recommendations*, we conclude by putting forward some general policy recommendations that build on the FLOK model. With a particular emphasis on public policies that steer learning and education, this policy proposal focuses on OER in the context of developing human capabilities that broaden and deepen access to knowledge.

INTRODUCTION: BASIC PRINCIPLES OF OPEN EDUCATIONAL RESOURCES

In contrast to notions of a knowledge-based economy that depend upon the use of patents and intellectual property rights to stoke innovation, the FLOK conception of a social knowledge economy applies inclusive IP rights in order to provide free and open access to knowledge. Highlighting the value of knowledge as a public good, Stiglitz (1999) reminds us that while scarcity may be a precondition for the economics of supply and demand, knowledge itself is not a scarce resource. As a public good, any number of people can construct, consume and use knowledge without necessarily depleting its' value. Indeed, this basic truth is critical to understanding the underlying meaning of a "social knowledge economy".

Beyond models of learning and education that are strictly aligned with capitalist production, there is mounting interest in the potential of new pedagogical and epistemological systems that emphasize commons-based resources and practices. Conventional systems of education, for example, often depend upon closed IP regimes that are generally expensive and inefficient in scaling educational resources. In the field of formal education, for example, this translates as open access (OA) science, open courseware (OCW), and the open education (OE) movement more generally. Notwithstanding the fact that the OE movement is a relatively new phenomenon, it is in fact part of a larger trend towards openness in learning and education that is directly linked to the affordances of information and communication technologies (ICTs). Viewed in the simplest terms OE includes:

- Learning Content in the form of courseware, content modules, learning objects, collections, and journals.

- Resources and software to support the delivery of learning content through learning management systems, content development tools, and on-line learning communities.

- Frameworks that support open intellectual property licensing to promote open publishing of materials, design principles of best practices, and the localization of content.

In the context of learning, commons-based education reimagines schooling as "Open Learning". This means more than expanding access to existing resources, it also refers to opening educational materials to the free contribution of all interested persons in building resources collectively. This nonstandard approach to creating educational resources challenges standard transmission models of education. Although still in its infancy, the growing trend towards collaboration between experts and peers carries formidable potential

2

for developing highly scalable learning resources. Indeed, in the era of virtual networks, experts and peers are no longer found in the classrooms and hallways of schools alone, they are found online.

One of the consequences of opening learning resources to free collaboration is that the control of educational institutions over learning is partially reduced. Knowledge and information can be accessed by anyone, anywhere, and so the formal authority of educational institutions is necessarily transformed. Despite this, the role of educational institutions will likely be critical to assessing and accrediting learning competence even in a world of open-access knowledge.

SECTION ONE: THE ECUADORIAN CONTEXT

It is no coincidence that rising demand for advanced education has developed in parallel with discourses on the "knowledge economy". Building on the need for competitive "human capital", economic policymaking is now increasingly oriented toward augmenting high-skilled labor. Indeed, it is within this broader global context that Ecuador's government has undertaken major restructuring of the country's education system, including 71 universities and 621,000 students. Beginning in late 2009 the government began conducting an evaluation of the country's universities in order to advance measures of quality assessment. Public policy and planning has been designed to make universities more selective in order to develop the skills and competencies needed to support Ecuador's growth. In 2008, for example, Ecuador's new Constitution eliminated tuition in public universities and in 2012, introduced aptitude testing as a means to admission to the country's 29 public universities. As the National Plan outlines:

> For the 2013-2017 period, our aim is to establish holistic education to achieve the socialist knowledge- based society and leap forward from an economy of finite (material) resources-based economy to an economy based on an infinite-based resource: knowledge. Efforts must focus on guaranteeing the right to education for all, under conditions of quality and equity, placing human beings and localities at the center. We will bolster the role of knowledge by promoting scientific and technological research responsible with society and Nature. We will construct emancipating knowledge, expand coverage and enhance quality at all levels of education. We will reinforce research to ensure scientific and technological innovation.

To contextualize recent changes in Ecuador's education policies, it is important to frame these changes in terms of the broader economic system in which the country's social development is now rooted. Ecuador's economy is the eighth largest in Latin America and has grown by 5.5% from 2002-2006 (the highest five-year average in 25 years). Although the country's GDP growth dropped to 0.4% after peaking at 7.2% in 2008, it has since rebounded to 3.6% (Center for International Economic Studies, 2012). Ecuador's macro-economic model is largely rooted in dollarization and petroleum production (Ecuador adopted the U.S. dollar following a major banking crisis and recession in 1999). In fact, the oil sector accounts for 50%-60% of the country's export earnings. This amounts to 15%-20% of GDP, and 30%-40% of government revenues. In 2010, for example, crude and refined petroleum products accounted for 56% of total export earnings. In addition to

3

petroleum production, manufacturing is primarily for the domestic market, with additional exports in agricultural products[1].

Beyond oil exports, President Correa's social and economic priorities include higher spending on social welfare programs that are coupled to state-managed economic growth strategies. Between 2006 and 2009, for example, the government increased spending on social welfare and education from 2.6% to 5.2% of GDP. This has included expansionary fiscal policies and large investments in education and infrastructure. With a constitutional foundation rooted in the development of social protection policies and a fundamentally new approach to expanding inclusive economic growth, the Correa government has become eager to introduce policies that can leverage State-managed postindustrial growth strategies in Ecuador. The country's national Plan, for example, builds on a language and rhetoric that looks to move the Ecuador beyond the quantitative measurements of economic performance in order to and establish a new vision for economic inclusion, transparency and citizen participation (Secretaría Nacional de Planificación y Desarrollo, 2010). In this way, *Sumak Kawsay* is rooted in a rights-based approach to development. This political model is grounded in Ecuador's 2008 constitution, and institutionalized by an expansion in governmental ministries (Internal Policy Center for Inclusive Growth, 2012). These ministries include:

- *The National Secretariat for Development Planning (SENPLADES)*
  SENPLADES integrates government goals and constitutional rights into policy and development plans.

- *The Ministry of Economic and Social Inclusion (Ministério de Inclusión Económica y Social) (MIES)*
  MIES develops policy and initiates complementary programmes to oversee the implementation of specific policies in line with development goals.

- *The Ministry of Social Development Coordination (Ministério Coordinador de Desarrollo Social)*
  Ministério Coordinador de Desarrollo Social oversees monitoring of social policies, coordinates different social institutions within the government and serves as the liaison between those ministries and the presidency.

In the view of the Correa government, reform of education has become fundamental to enhancing Ecuador's social and economic capacity. With this in mind, this policy proposal emphasizes the need to integrate commons-based resources into the larger planning of the Ecuadorian education system.

While a large proportion of children are educated through primary and secondary schooling, Ecuador does not fully educate its population. At the higher education level, for example, approximately 80% of Ecuador's young people attend public universities with a broad range

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[1] Ecuador is the world's largest exporter of bananas and plantains (about $2 billion) and a major exporter of shrimp ($828 million) and cacao ($402 million).

in quality. More problematically, however, the graduation rate at public universities is rarely more than 15%. In response to these educational deficits, the government's National Plan outlines several key targets for managing education policy. These targets include:

- To increase the percentage of people from age 16 to 24 who have completed basic schooling to 95.0%.
- To increase the percentage of people from age 18 to 24 who have graduated from high school to 78.0%.
- To reduce the dropout rate in the 8th year of basic schooling and the first year of high school to 3.0%.
- To increase Internet access in schools to 90.0%.
- To increase enrollment in higher education to 50.0%.
- To increase enrollment in technical and technological institutes to 25.0%.
- To achieve 80.0% rate of students in higher education who complete their degrees.
- To achieve 85.0% rate of university professionals who have graduate degrees.

SECTION TWO: EXAMINING THE KNOWLEDGE ECONOMY

As Ecuador's National Plan points out, the economic necessity for reducing dependency on natural resources and accelerating engagement with building a "knowledge economy" is now viewed as key to the country's future economic development. Unlike the tangible assets underlying the industrial economy- land, labor, capital, and raw materials, the knowledge economy is largely associated with intellectual labor and "mind work" (Toffler, 1990; Drucker, 1993). Indeed, a recent European Union statement emphasizes the view that "Innovation is by far the most important driver of growth and productivity. As much as 85% of productivity growth in modern, developed economies is the direct result of innovation" (Lisbon Report, 2013).

Where neoliberal economic theory views knowledge as exogenous (or external) to growth, more recent theories on the knowledge economy locate knowledge and innovation at the center. This includes strategic investments in learning and education for the purpose of expanding economic capacity. According to the National Plan, the development of Ecuador's knowledge base has the potential to "bring the country from a phase of dependence on limited resources to one of unlimited resources, such as science, technology and knowledge" (*Buen Vivir*, p. 19). Building on developmental models common to East Asia (e.g., Japan and South Korea), Ecuador's government has begun developing policies and planning that emphasize government driven investments in advanced manufacturing and high-technology goods.

This conceptualization of an Ecuadorian knowledge-based economy builds upon distinct notions of *human capital theory* argued by Becker (1975) and others. As Becker put it, "... expenditures on education, training, medical care, and so on are investments in human capital" (p. 74). Indeed, the 2013 National Plan promotes a strong recognition of the importance of education to a prosperous and democratic society. Building on an explicit emphasis of advancing a knowledge-based society, the Good Living Plan aims to develop "holistic education" that might generate an economy that leaps   beyond a "finite

5

(material) resources-based economy". To this end, education and training are now considered long-term *investments* for the wellbeing and future prosperity of the country. As the 2013 Good Living Plan elaborates:

> Efforts must focus on guaranteeing the right to education for all, under conditions of quality and equity, placing human beings and localities at the center. We will bolster the role of knowledge by promoting scientific and technological research responsible with society and Nature. We will construct emancipating knowledge, expand coverage and enhance quality at all levels of education. We will reinforce research to ensure scientific and technological innovation.

Rather than a return to the Keynesian redistribution policy framework of the 1970s (Chenery et al., 1974), however, education and social welfare are seen as key to stimulating long-run socioeconomic expansion (Pierson, 2007; Esping-Andersen, 1990; Nederveen Pieterse, 2012). From this perspective, knowledge itself is directly linked to social well-being in a large number of non-monetary areas of life, including health, family life, community organization, childcare, cultural appreciation and generally, human development and individual self-actualization. This is one reason that the school curriculum in most countries in the world is devoted to many civic, cultural, and relational aspects of life.

So, we are reminded that there are two aspects to investing in knowledge. While it is important to view education and human learning as investments for economic development, it is also important to view literacy, basic education and higher learning as means to a better living all around.

Sustained investment in basic education should include a balanced focus on literacy, digital literacy, health, family life, community organization, childcare, cultural appreciation and human development. Access to first language instruction should be afforded.

SECTION THREE: THE OPEN KNOWLEDGE COMMONS

Given the rising demand for skilled labor, it is hardly surprising that education and human capital development are now widely shared policy goals across developing and developed countries alike. Theories on Endogenous Growth, for example, view economic development as an "endogenous outcome of an economic system, [and] not the result of forces that impinge from outside" (Romer, 1994: 4). Beyond the policy dichotomy between economic policy and welfare policy, Endogenous Growth Theory (EGT) suggests that social policy should play a key role in driving economic growth. Indeed, EGT reaffirms the idea that long-run growth depends on social investments in policy and planning.

While classical economics recognizes the need for active investments in education on the grounds that education enables positive externalities, EGT holds that the value of skilled labor rises as human capital increasingly drives economic expansion. Where conventional economic theory attempts to capture and define the value of labor in terms of market transactions, HCT makes the claim that investments in education can directly enhance growth. Principles underlying HCT, for example, include techno-scientific innovation, the

6

codification of knowledge through information and communication technologies (ICTs), the commodification of knowledge through intellectual property regimes, and the production and circulation of knowledge by and through knowledge networks (Peters, 2009).

Where education policy may have been closely linked to discourses on social justice and/or national cohesion in the postwar period, international models of education policy are now more commonly interpreted as a feature of discussions on market growth and the "refinement" of human resources. As Garrison (2012: 370) deftly notes:

> The marvelous industrial idea of the nineteenth century was the refinement of natural resources into standardized, hence readily interchangeable and replaceable, parts for the national production function. The marvelous postindustrial idea of the twenty-first century is the refinement of human resources into standardized, hence readily interchangeable and replaceable, parts for the global production function. Schools serve as the site for smelting and refining human resources.

But what precisely is the role of institutional education in era increasingly dominated by technologies that support democratic collaboration? In their article "Minds on Fire" (2008), John Seely Brown and Richard Adler attempt to answer this very question by considering the educational potential of social networks. Just as peer communities are transforming the production of software, Brown and Adler speculate that social learning communities will transform the production of education. As they observe, the Internet and related network technologies are enabling a revolution in social learning that is interdependent with highly distributed communities-of-practice. Unlike the traditional Cartesian approach centered on the individual learner, social learning networks depend upon highly developed forms of community apprenticeship:

In a traditional Cartesian educational system, students may spend years learning about a subject; only after amassing sufficient (explicit) knowledge are they expected to start acquiring the (tacit) knowledge or practice of how to be an active practitioner/professional in a field. But viewing learning as the process of joining a community of practice reverses this pattern and allows new students to engage in "learning to be" even as they are mastering the content of a field. This encourages the practice of what John Dewey called "productive inquiry"—that is, the process of seeking the knowledge when it is needed in order to carry out a particular situated task. (p. 20)

Brown and Adler connect this communities-of-practice approach to a larger shift in institutional education itself. Just as peer producers are collaborating across distributed networks to create dynamic products and services, they contend that the future of education lies in opening up the design and development of courseware and curriculum to peer production. As they observe,

> We need to construct shared, distributed, reflective practicums in which experiences are collected, vetted, clustered, commented on, and tried out in new contexts. One might call this "learning about learning," a bootstrapping operation in which educators, along with students, are learning among and between themselves. (p. 28)

For Brown and Adler, this is education as "passion-based" learning in which students become apprentices in self-organizing social networks. Underlying this communities-of-practice model is a resource-driven understanding of education in which the World Wide Web represents a rich storehouse of tools and resources for ongoing cultural innovation. This knowledge commons includes open courseware and access to powerful simulation models, as well as open access to scholarly websites and journals. They write:

> This new form of learning begins with the knowledge and practices acquired in school but is equally suited for continuous, lifelong learning that extends beyond formal schooling. Indeed, such an environment might encourage students to readily and happily pick up new knowledge and skills as the world shifts beneath them. (p. 32)

SECTION FOUR: CASE STUDIES

The cornerstone of the FLOK model is the free and open sharing of knowledge. By democratizing access to technology and knowledge through the use of open licensing, the FLOK approach seeks to empower communities to participate in the production and consumption of knowledge. In this way, the FLOK model challenges the predominant view that closed IP driven education systems provide the foundation for scaling access to learning and education. Instead it suggests that the development of a knowledge-based commons provides a more advanced platform for scaled access to knowledge and learning. One clear example of a successful knowledge commons supporting OER is the Connexions project at Rice University.

Case-study 1: Connexions: Democratizing the Knowledge Commons

Launched in 1999, Connexions is a cross-disciplinary knowledge commons that fosters the ongoing construction of tools and resources for all levels of education (Connexions White Paper, 2004). Inspired by the tremendous growth of open-source software, Connexions is designed to offer students and educators access to modular resources from around the world. Authors contributing to Connexions retain copyright on all resources but make them freely available under a Creative Commons license. To ensure the reusability of content, Connexions requires authors to license materials they publish under the Creative Commons Attribution License. Under this license, the author retains the right to be credited (attributed) wherever the content is reused.

As a resource repository, Connexions is constructed as a globally-distributed environment that transcends the exclusivity of classroom knowledge transmission. While knowledge is traditionally transmitted to students in highly formalized stages, Connexions offers students the possibility to access the knowledge continuum in its entirety. Using a P2P architecture, Connexions operates as a single, nonlinear network that can enable students and researchers to enter into the knowledge continuum from any point of interest. Most importantly, by giving anyone access to the entire continuum, Connexions encourages students and teachers to perceive the "big picture" of knowledge in a holistic way:

The traditional method of transmitting this information- textbook publishing- is inefficient. In contrast to the rate at which the knowledge continuum changes, it is a glacial process. The

8

dynamics of the system are lost; students receive what is essentially a still photograph of the continuum at a given point in time. Textbook authors must devote several years to writing their books, and then their work is subject to editorial review. Finally their books enter the printing and marketing cycle. This is a substantial time commitment for college professors. Thus, textbooks are, almost by definition, stale even at the date of their publication. Knowledge that is evolving at a rapid pace, such as in computer science, environmental science, bioinformatics, and medicine, can never be captured by this traditional delivery method. (Connexions 2004, p. 3)

Designed around an open-content license, Connexions supports a globally inclusive authoring environment for teachers, researchers and students. Authors can build on and advance anything in the Content Commons. While educational modules are encoded in a single language (XML), modules can be translated into a number of media formats including HTML, PostScript, PDF, Microsoft Word and PowerPoint. Moreover, modular units stored in the Commons can be combined and used in an infinite variety of courseware packages.

The collaborative nature of Connexions fuses participatory feedback to iterative improvement in the ongoing expansion of the repository. In this way, Connexions facilitates self-organizing prosumer improvement without limiting access. Using visualization and navigational tools, curriculum developers can continually mine a rich repository of highly scalable resources. In turn, using post-publication editorial and review, specialists can utilize independent standards to harvest quality materials suitable to domain specific needs. Moreover, third party editorial boards can employ independent lenses to filter and manage the raw resources as needed.

Available free of charge to anyone under an open-content license, Connexions aims to enable a large-scale repository for global learning communities. While the Content Commons repository remains technologically centralized, the goal of Connexions is to grow its' infrastructure along with its reach in order to enable a truly globally-distributed P2P ecosystem. Deliberately designed to support global collaboration, Connexions is a concrete example of a distributed network supporting prosumer communities. In this regard, Connexions represents a strong model of the tremendous scalability of collaborative networks to facilitate user-driven learning. More to the point, as a knowledge commons, Connexions offers a comprehensive framework for considering the development of educational tools and resources for democratic innovation.

Case-study 2: Peeragogy: Peer Produced Peer Learning

The Peeragogy project is a virtual community for facilitating the reflective practice of peer learning and peer production. The project synthesizes communication and contributions from globally diverse, widely-distributed members -- including teachers, designers, and other professionals, as well as students and committed enthusiasts. The Peeragogy project has co-evolved with a range of practical applications of peer learning and peer production -- in classrooms, community groups, and businesses. This document summarizes a research project that helped informed the growth and progress of Peeragogy.

9

Case study: How to turn a peer produced reference resource into a peer learning environment?

Background. PlanetMath.org was founded in 2001 as a site for discussing mathematics and collaboratively building a mathematics encyclopedia. It was the subject of Aaron Krowne's 2003 Masters thesis "An Architecture for Collaborative Math and Science Digital Libraries", written at the Virginia Polytechnic Institute and State University (Virginia Tech) under the supervision of Ed Fox. In 2010, PlanetMath was re-visioned as a learning community as part of Joseph Corneli's PhD research at The Open University, UK. This project required a new understanding of peer produced peer learning.

Methods. In 2010-2011, Corneli and coauthors developed a framework for studying change in peer learning communities. Paragogy is distinguished from pedagogy insofar as crucial changes take place at both the individual level ("learning") and the collective level ("adaptation"). The paragogy framework was employed to gather and analyse requirements from a range of stakeholders in PlanetMath, including students, teachers, and researchers. These design requirements informed the development of a new software system for PlanetMath. In parallel, this work informed Howard Rheingold's conception of the Peeragogy project. Starting in 2012, Rheingold and over 30 co-authors worked to develop a robust collection of practices and patterns for doing peer learning on multiple scales, collecting and collating varied case studies and examples in the Peeragogy Handbook. One of the innovations in the Peeragogy project was the development of a catalog of design patterns. These patterns were employed in the evaluation of the PlanetMath rebuild.

Outcomes. In the course of the study on PlanetMath, a pattern-based analysis of user behavior and feedback led to the creation of 3 new design patterns that encapsulated users' co-designs of further improvements to PlanetMath's software system. These new design patterns also helped to enrich the Peeragogy knowledge base.

Implications for the FLOK project and Ecuadorian policy

Peer learning and peer production benefit from participatory engagement at every level. Rather than "providing" an infrastructure, it is preferable to build systems for collaboration that are themselves peer produced, since this offers users rich opportunities for meaningful engagement. The Peeragogy project's pattern catalog is one such mechanism, which has been employed to do participatory design. As the case study shows, this catalog continues to improve through use and discussion. The Peeragogy Handbook, including the latest version of this catalog, is developed in public using peeragogical methods. It is available under the terms of the Creative Commons Zero license, so it can be freely adapted. Translations into multiple languages, including Spanish, are already underway. In addition, the Peeragogy community can provide support: project members are actively interested in collaborating with practitioners in peer learning projects at the level of the neighborhood, the nation, and beyond.

SECTION FIVE: PUBLIC POLICY RECOMMENDATIONS

10

To appreciate the macro-structures that inform human capabilities development in Ecuador, it is important to understand the multiple models of policy and planning that are used to steer learning and education. Beyond market-based approaches to enhancing Ecuadorian human capital development, for example, there are many successful policy models around the world that emphasize state planning. In the Nordic countries of Europe, social investments linked to learning and education have been critical to their socioeconomic development. Where neoliberal theorists underscore the value of self-regulating markets, for example, "social investment" theorists point to the long-term importance of articulated investments in education and social welfare. Indeed, Hemerijck (2012) suggests that *Social Investment Theory* is rooted in the Nordic "social democratic" model particularly the Swedish welfare state of the 1930s.

Building on the social policies of Alva and Gunnar Myrdal (1934), State-lead support for public education, healthcare, and social welfare are seen as a long-term investment in future prosperity. From this perspective, the focus is on targeted provisions for the young and on their future employment (Jenson and Saint-Martin, 2003) with the belief that "Solid investments in children now will diminish welfare problems among future adults" (Esping-Andersen et al., 2002: 51). Overlapping social policies found in the Nordic welfare state, social investment is distinguished from other types of welfare models by its emphasis on maximizing labor force participation (Table 1). As Hemerijck (2011: 14) elaborates,

> The logic of "social policy as a productive factor" contrasts with neo-classical economics in three crucial dimensions. In the first place, neo-classical economics, based on perfect information and market clearing, theoretically rules out the kind of social risks and market failures that the welfare state seeks to address. Secondly, because neo-classical economics focuses only on the (public) cost side of the welfare state, it is unable to appreciate its core macro- and micro-economic benefits. Thirdly, even where markets function well, collective action problems may obstruct the creation of public goods if participation in the policy cannot be guaranteed and defection is likely. Markets are destined to undersupply education, the benefits of which cannot be internalised. Extensive comparative empirical research has since the turn of the century revealed that there is no trade-off between macro-economic performance and the size of the welfare state. The presence of a large public sector does not necessarily damage competitiveness. On the contrary, there is a positive relationship between fertility and high levels of female participation in most Scandinavian countries…

Where neoliberal theories on the knowledge economy emphasize the importance of private investments in education, Lundvall (2004) and other theorists on human capacity development emphasize public investments aligned to the needs of a global knowledge economy (Table 1). The concept of the *Social Investment* State, for example, argues for the need to redesign social policy in response to the increasing pace of knowledge obsolescence. Underlying the social investment literature is a stress on active welfare policies that respond to growing social challenges facing economies in the era of globalization.

Based in part on the above case studies, it would seem obvious that OER systems have the capacity to leverage significant gains in the development of human capabilities. Indeed, it is

11

our view that restrictive IP rights run counter to the aims and needs of a social knowledge economy. Against the background of this analysis, we propose specific and tailored policy recommendations for transforming learning and education in Ecuador. Much as the OS movement, the key differentiator between OER and any other educational resource is its license. In this sense, OER is simply an educational resource that incorporates a license that facilitates reuse without first requesting permission from the copyright holder. Open Access publishing, for example, typically enables research publications of some kind to be released under an open license. In this sense, OER directly overlaps much broader questions about post-capitalist and post-proprietary models of society and economy.

1. Policy Recommendations for Higher Education
Ecuador already has a law regarding free software and open knowledge (Decreto 1014, 2008). Article 32 of the *Ley orgánica de Educación Superior* makes open software mandatory for higher education. Public universities are building their own OER repositories. This trend should be supported and expanded until all resources used in higher education are accessible, open and free to all.

But open learning also means opening up learning. Institutions are no longer the sole providers of knowledge, and they must adapt quickly to this new reality. They now have an added new role to play in supporting the nation's education: encouraging, supporting and accrediting open learning - this means that institutions must be prepared to formally recognize informally acquired knowledge.

In order to promote such an agenda, there are some obvious requirements.

1. Ecuador needs a higher learning institution - either free standing or through existing structures - that is committed to innovative open learning at a low cost. This would serve as a laboratory to begin spreading open learning across all institutions.

2. Accreditation of higher learning should be standardized across all higher learning institutions. Methods of assessment should focus on the *outcomes* of learning rather than the process or the source of learning as is currently the case in closed classroom settings.

3. Accreditation of learning should be competence-based and not time-based. Acquisition of knowledge is independent of duration of study.

4. A service of Prior Learning Assessment and Recognition (PLAR) should be instituted in order to open the accreditation process for learning that has occurred independently from program structures, including informal learning, OERs, and MOOCs. The intent is (1) to shorten degree-granting programs by recognizing previously acquired competencies, and (2) to facilitate the transfer of credits from one institution to the other.

5. Legislation is needed that limits the reach and scope of copyrighted materials, especially with regards to "fair usage" in educational settings. Fair usage is the traditional understanding that for educational purposes the use of copyrighted materials is allowed, in a reasonable and "fair" way.

12

2. Policy Recommendations for Basic education
Significant economic, technological and social changes emerging within a knowledge economy require that formal education redefine its' underlying assumptions. For educationalists like Bereiter (2002) and Scardamalia (2002), education in a knowledge economy is inherently linked to the capacity of all students to advance knowledge and ideas. They suggest that the health and wealth of societies depends increasingly on leveraging creativity. For this reason, Bereiter and Scardamalia suggest that the creative construction of new theories and ideas is the key to reshaping education. While traditionally, education systems have been constructed to support cultural reproduction, they have not given students the experience of independent idea improvement. As Bereiter and Scardamalia point out, people in general and not just a specialized elite need to be able to work creatively in the production of knowledge. What this means is that students of all ages must be directly engaged in the creation process.

As Bereiter and Scardamalia observe, the key to unlocking this potential is developing education as "knowledge building". This means fostering democratic communities around a shared knowledge commons. By connecting specialized communities to a shared environment, knowledge building can potentially enable cross-pollination and continuous idea improvement. As they point out, it is not enough to simply require students to master the component skills of knowledge creation: critical thinking, the scientific method, etc. The technological, social and ethical needs of a rapidly globalizing society will require people that can creatively construct and evolve new tools, ideas and practices. While pedagogy for mass education largely aimed at student mastery of established knowledge, education in a knowledge economy must work to scaffold creativity itself. Through the process of building knowledge collaboratively, students can achieve epistemic agency- that is, share in a cooperative effort for making knowledge innovation successful and of benefit to all.

As Bereiter and Scardamalia point out, a conservative bias within the structure of mass education has reduced knowledge creation to an elite few. The fact that it is only at the graduate level that students are actively encouraged to create knowledge is now becoming a significant problem. If knowledge innovation is to genuinely constitute the foundations of a knowledge economy, then public education must begin to move beyond transmission models that focus almost exclusively on "social reproduction".

The promises of the digital age for opening educational resources is not the sole domain of higher education. It also has implications for all levels of basic education. Teachers and students alike now have the possibility to access online resources - if they are provided with digital **connectivity**, that is. The National Plan calls for reaching a level of "90% internet access in schools".

 In regions where access to broadband connectivity is limited, an alternative system must be created. One reasonable alternative to fiber optics would be to use the telephone signal antennas that cover much wider areas of Ecuador. Currently, the main obstacle to **mobile learning** is the high price that mobile providers charge for accessing data through their

13

system. At the very least, educational institutions should have access to mobile data at a reasonable price. A more futuristic development, but not entirely unreasonable, resides in the current experiments to enable tethered high-altitude balloons to carry digital wireless signals to remote areas.

In parallel to digital access, a program of **digital literacy** would offer students the opportunity to enter in the digital age and engage in building their own personal learning environment. The school then becomes a place, among possible others including the home, where open learning resources are accessed.

In the new environment, the role of teachers is transformed as well. From the holders of knowledge and distributors of learning, they become facilitators who help navigate networks of interconnected information and persons. There would therefore be a need to prepare teachers for this new role. University programs for **teacher training** would have to be adapted to the digital reality.

In an interconnected environment, knowledge is built by collectively seeking answers to self-defined questions.

The National Plan also calls for "efforts (that) must focus on guaranteeing the right to education for all". More specifically its aims are:

* To increase the percentage of people from age 16 to 24 who have completed basic schooling to 95.0%.
* To increase the percentage of people from age 18 to 24 who have graduated from high school to 78.0%.
* To reduce the dropout rate in the 8th year of basic schooling and the first year of high school to 3.0%.
(Plan Buen Vivir, quoted in D. Araya December Research Report, FLOK Society)

Currently, the Government's expected years of schooling is 13,7 years (compulsory schooling is 10 years), but the average adult school completion in Ecuador is 7,6 years (UNDP, 2012). It is not clear, however, whether the cause of low participation is accurately defined as a problem of "access". There is a world trend of non-participation in basic education. Numerous studies have attempted to explain this social phenomenon, with mitigated results. More commonly, a multi-factor correlational influence is identified.

1. Develop an infrastructure to avail all the Ecuadorian communities - particularly schools - with affordable broadband connectivity. Invest in mobile data access.

2. Establish an early school program in digital literacy.

3. Reform teacher-training programs to include cooperative education and digital experimentation.

4. Establish a research program to determine the causes of non-completion of schooling.

14

Conclusion

Even though it can be shown that open knowledge has earned the support of many important stakeholders, it is also true that there is an opposing trend that directly contradicts it. The first manifestation of this trend is the radicalization of copyright legislation in some countries. For example, the governments of the U.S. and Canada have recently passed legislation giving copyright owners sweeping powers to enforce their dominion in the age of digital reproduction (cf. The Millenium Act and Bills C-11 and C-32).

Second, the notion of openness has yet to be accepted as desirable by numerous institutions such as universities, research laboratories and publishers in Ecuador and elsewhere. There is a persistent understanding that education materials including textbooks, course development and other resources are the property of the institution that has created them and should only be accessed by its paying customers. Similarly, many research and development laboratories, in Ecuador and elsewhere, actively resist the idea that sharing innovation can procure higher returns than preserving it behind patent regulations.

The third threat to open access is corporate piracy. One widespread instance of corporate piracy is found in academic publishing, where scholars are paid by their institution, often with public resources, to create new knowledge and to publish it - but where the publication industry appropriates the work and disseminates it for a large profit, not shared with anyone. Sadly, the practice among academic employers of valuing academic production by establishing what constitutes a "reputable" publication (often seen as opposed to an open-source one), is in no small way responsible for academic piracy.

Another instance of commons piracy - and one that may be of particular interest to Ecuador - occurs when publicly shared knowledge is patented or copyrighted by external private interests. For example commons piracy occurs when community shared knowledge such as ancestral agricultural techniques or traditional medicinal properties are copyrighted and patented by private interests. This is a very real and current concern for rural and traditional peoples around the world, as illustrated by the infamous attempts at patenting basmati rice in India. Another example of intellectual commons piracy is U.S. jurisprudence being controlled by West Publishing as the sole provider of legal texts written by public magistrates. This has prompted Wired Magazine to ask, Who owns the law? Again in this instance, public knowledge is appropriated by a private interest.

15

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17