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2016

Bentley, C. M., & Chib, Arul. (2016). The Impact of Open Development Initiatives in Lower- and Middle Income Countries: A Review of the Literature. The Electronic Journal of Information Systems in Developing Countries, 74(6), 1-20.

<https://hdl.handle.net/10356/81510>

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THE IMPACT OF OPEN DEVELOPMENT INITIATIVES IN LOWER- AND MIDDLE INCOME COUNTRIES: A REVIEW OF THE LITERATURE

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ABSTRACT

The purpose of this paper is to explore the field of open development in lower and middle income countries (LMIC) through a review of the literature. We examined 269 articles between 2010 and 2015, that were retrieved through keyword searches of the Scopus database and four ICT4D journals. This article adopts the pathway of effects model to analyze contributions according to inputs, mechanisms and outputs of open initiatives in LMICs. The review finds a fairly even spread of articles across the three stages of effects. Studies that disentangled reasons why or why not openness makes a difference provided the most insight to underlying mechanisms and impact of open initiatives. We found very little evidence that research within this area is concerned with the perspectives of poor and marginalized people – notably women. We therefore question the normative value of open development as a means to transform power relations. However, we argue that a more concentrated vision within this field is needed to exploit the full potential of digitally enabled openness for development.

Keywords: Open development, open educational resources, open government data, open source software, crowdsourcing, peer production, ICT4D research

1. INTRODUCTION

There has been a great deal of progress around the conceptualization, and usage of open development by a variety of actors and individuals within the past five years. Civil Society Organizations and networks are applying open development tools and concepts to address a range development problems (Ardema, 2012; KLL, 2016; Yaseen et al., 2016), as well as to enhance a variety of initiatives and processes (Harvey, 2013; Ndunda, 2012; Young, 2014). National governments have established open programmes and commitments to open up hitherto firewalled databases in order to engage citizens through open data and e-government strategies (Maddon, 2009; Rahemtulla et al., 2011; McDermott, 2010); as well as to improve essential services such as education (Hoosen, 2012). Multilateral and bilateral donors are simultaneously developing their own open development agendas in order to share their knowledge and experience more widely, while establishing a means for better governance and accountability of development aid resources (World Bank, 2011; DFID, 2013). Reilly and Smith (2013) have argued that open development is a progression from ICT4D and that new social innovations can radically change the development landscape.

A main driving interest within the area of open development has been to examine the potential for digitally-enabled openness to empower and transform individuals and societies (Smith and Elder, 2010). For example, by creating new avenues for citizens to provide feedback (Gigler et al., 2014), offering accessible ways for people to receive education for free (Jobe and Hansson, 2014), and enabling groups of women to advocate for safer neighbourhoods to live in (Young, 2014).

However, what is lacking in the scientific discourse in order to achieve broader societal impact is evidence to make clear connections between the promise of open development and the development outcomes that transpire. This paper interrogates the promises of open development through a rigorous review of mainstream and ICT4D literature from 2010-2015. We achieve this aim by using the pathway of effects framework, the input-mechanism-output framework (IMO),

used previously to examine mobile healthcare (Chib et al., 2014) and mobile finance initiatives (Chib et al., 2015) in developing countries. We investigate the impact of open development initiatives in LMICs in terms of technology introduction, contributing factors, and development outcomes.

Figure 1. The Pathway Model

Source: Adapted from Chib (2014).

First, we note that scholars within this area adopt varying and divergent definitions of development and/or open development whilst many authors provide no definitions at all. An early conceptualization by Smith and Elder (2010, p.66) of open development was:

1. Universal over restricted **access**;
2. Universal over restricted **participation** in informal and formal groups/institutions; and
3. **Collaborative** over centralized production.

Smith and Reilly (2013) later argued that open development is constituted by the application of open models to international development, in which they describe open models as distinct configurations of content, people and processes to connect them together. For example, open source software usually has no restriction to download or use the software and source code is modifiable by anyone with the skills to do so. They also stressed that it is about “harnessing the increased penetration of information and communications technologies to create new organizational forms that improve the lives of people” (Smith and Reilly, 2013, p.4). An open model is not always sufficient for open development to happen, but the assumption is that decentralized collaboration and sharing can be harnessed to benefit greater numbers of people in more effective ways than through traditional development practices alone.

In this review, we examined research by authors who referenced an open model within their work. Development, however this might have been understood, was included as a means to explore how researchers in this area are currently engaging with open models in LMIC contexts. That being said, with the adoption of the 2030 Agenda for Sustainable Development Goals (United Nations, 2015), we recognize that the definition of development, as negotiated by scores of stakeholders, remains in flux. It is likely that while development broadly will continue to face scrutiny and be a negotiated process, the transformed nature of the goals does suggest greater inclusion and a bottom-up approach to tackling global poverty (and hunger).

In terms of the underlying framework, when considering the outputs category, different interpretations of development impact were considered important when classifying outcomes. We did not prioritize particular research methodologies or types of impact in a strict hierarchy, but our own views led us to look for evidence of positive social change and transformation. In terms of

methodology, the rigor and systematicity of studies were subject to critique from an internal consistency point of view.

Further, we interrogate the intertwined nature of open development and ICT for development. Nuances surrounding the core meaning of development and its wide interpretations are perhaps where critiques of open development stem from. For example, Singh and Gurumurthy (2013) argued, that openness can actually make ‘development’ worse. For instance, that open information and knowledge distributed through mobiles is often commodified and establishes entrenching dependencies. Benkler (2010) said that a smart-phone networked environment capable of modelling itself to the open Web would require voluntary large-scale business decisions to give up control of mobile-based infrastructures like apps, or for regulatory intervention to take place at the policy level. The roles and responsibilities of governments, regulatory and international organizations, and how and whether they can interact with private sector interests to create open development environments is not yet clear.

A further vein of this critique is that the advent of social media platforms and networked socialization are divorcing social movements from the forces that propel fundamental social change (Schlozman et al., 2012). Civil society movements have been successful when masses of people make ethical ideals a reality at all levels of society—business, law and family-life—combined (Edwards, 2009). Hashtag activism is an example of when social movements mobilize around a cause but fail to dismantle the structures that stand in the way of improved human rights and liberation (Filar, 2014). It is not clear what cultural and political conditions are necessary for openness to improve rights, liberation, civic participation and activism.

Lastly, there is also the critique that existing ideas and practices of development condition the ways in which actors approach open development, and that open development should therefore be understood as embedded within wider global and societal contexts and ideologies (Buskens, 2013). Buskens’ (2013) point is that open development researchers need to critically engage with the intentionality of their efforts in order for this area to fully realize its potential. Although open development has presented a wealth of potential and some positive examples, what we should take from lessons in ICT4D is that open development is not merely about the possibilities but about what should be done, and that how open development is performed has a profoundly moral agenda (Tacchi, 2012; Unwin, 2009), and that a multiplicity of voices are required for the challenging task of creating social impact (Chib, 2015). There is also a need to better understand how open development could help researchers adapt to and respond to methodological, ethical and theoretical challenges in multi-disciplinary and critically engaged ways.

Overall, this review is guided by three primary narratives within this area: 1) that digitally-enabled openness provides greater access and can potentially enable greater inclusion of poor and marginalized people and perspectives; 2) that the decentralized nature of open models can potentially redistribute power and result in more efficient and effective collaboration outcomes; and 3) that the emergence of open phenomena is constituting a new form of development all together, which requires greater understanding, critique and debate.

The next section details the procedures we used to collect and analyze open development literature. Following this, the literature was organized into three main groups and the results are organized along the lines of inputs, mechanisms and outputs. The article ends with a discussion of the main definitional and empirical problems of open development while highlighting the contributions of the ICT4D community in this regard.

2. METHODS

2.1 Inclusion and Exclusion Criteria

We included articles in this review when they met the following criteria: any study that related explicitly to open development, and those that studied themes and practices relating to open development. Themes and practices were drawn from Smith and Elder (2010). This means that we included research that concerned digitally-enabled openness in the context of development, however development is defined. We included peer-reviewed and non-peer reviewed literature.

Any article, conceptual or empirical, was included but only if it took place or referenced low- or middle-income countries as categorized by the World Bank (2016). References to developing countries and/or developing regions were also included. Articles in all languages were included; however, there were only seven articles in Spanish and two in Portuguese. All other articles were written in English. We excluded research that did not reference openness through ICTs specifically. We excluded technical research if authors did not make links to LMIC contexts in either a general or specific sense.

2.2 Search Methods

We came up with keywords to search for literature during a brainstorming session and we identified 24 terms associated with open development (see Table 1). The keywords are divided into three sections, based on Smith's (2015) taxonomy of open development.

Table 1. Search Keywords

Thing	Process	An assemblage of things and processes
Open educational resources Open Internet Open source software Open data Open hardware	Open participation Open collaboration Open learning Open sharing Open content creation Peer production Crowdsourcing Open knowledge sharing Open governance	Open development Open access Open education Open health Open government Open society Open innovation Digital commons Peer 2 peer/peer-to-peer Open science

Source: Adapted from Smith's (2015) taxonomy.

Using the keywords in Table 1, we searched the Scopus database for relevant articles. Four ICT4D journals (EJISDC, Information Technology in International Development, Information Technology and Development and Journal of Community Informatics) were also searched and screened individually using the same keywords and inclusion and exclusion criteria.

2.3 Data Extraction and Analysis

Initial search results from the Scopus database were subjected to title and abstract screening based on the inclusion and exclusion criteria. Any duplicate entries from the databases were removed. Next, full texts of articles with relevant abstracts were downloaded. A complete list of all included articles can be downloaded at http://www.sirca.org.sg/?attachment_id=38691. After obtaining the final set of articles, these were coded based on their content following Gomez's (2013) procedure and elaborated to categorize open development specifics. Gomez's (2013) ICT4D content analysis procedure contains exclusive and interpretive codes relating to the place, scope, research questions and findings of the study. The articles were further categorized according to the type of intervention or main purpose of the article: inputs, mechanisms and outputs (Figure 1). One author coded over 80% of the articles, and two coders received support from the author to read and code another 42 articles. The Spanish and Portuguese articles were coded by a native Speaker. All extracted data from each study were compiled in a standardized Google spreadsheet. Coding was particularly challenging when authors made no attempts to explicitly state their development aims or research questions. Some authors used the majority of their article to describe mechanisms or impacts with no empirical findings to substantiate their claims. Such articles were classified as inputs as a result. One article was not classified as an input, mechanism or output because it was a workshop plan. Overall, we assessed the best fit of the article as a means to select the most

appropriate category for it. This review therefore uses the pathway of effects only as a means to comment on approximate trends.

Following the first round of coding, articles were then grouped and analyzed according to the input, mechanism and output categories. Within each group we used types of research identified by Chib et al. (2014; 2015) as a starting point. If an article did not fit within the existing pathway model, a new factor/type was created. These new factors were modified through constant comparison (Glaser and Strauss, 1967). We also sought to analyze whether there were any changes over time in the way that researchers approached open development research by examining Gomez's (2013) code for the role of ICT in society. This code is meant to represent how researchers both think about and approach ICT within their article. The category included: 1) ICT as a social phenomenon; 2) ICT as a social phenomenon with technical implications; 3) ICT as a technical phenomenon and 4) ICT as a technical phenomenon with social implications. For example, ICT as a social phenomenon means that the researchers have taken an approach that studies the ICT according to its context in use, which implies that interpretations are drawn based on a social-embedded view of technology. Although there was a relatively low inter-coder reliability in Gomez's (2013) research, most of the articles in this study were coded by one person. Regardless, we find this code useful to give an impression, in a general sense, how researchers' approaches are intertwined with their beliefs of how ICT impacts society. These results will be presented in Section 3.4.

3. RESULTS

From the Scopus database, we obtained over 4000 articles from the keyword search. After title and abstract screening, we narrowed this down to 443 articles from Scopus and ICT4D sources combined. These articles were then examined in full and assessed according to our inclusion criteria. 269 articles passed our inclusion criteria and were read and coded entirely within this review. Overall, there was a wide spread of articles with open government data (OGD), open educational resources (OER) and open source software keywords returning over half of the total articles (Figure 2). Some keywords, like open sharing, produced few or no results. Correspondingly, education, governance and economic development aims were most frequent. Almost a third of the studies were concentrated in China and Brazil. Other popular countries of study were India, South Africa, Kenya and Indonesia. A total of 54 countries were represented, as well as others that were grouped into regional studies.

Figure 2. Type of Openness **Source: Authors.**

3.1 Inputs

There were 93 articles that were related to inputs such as tools and approaches, infrastructure environments, and access and outreach dimensions of open development within LMICs (Figure 4). Of these 93 articles, only 7 (8%) were published in ICT4D journals. The majority (63 out of 93 or 68%) of research on inputs discusses tools and approaches, largely from a design or technical perspective. Infrastructure including institutional and policy arrangements were 25% (23 out of 93), while 5% (5 out of 93) treated issues surrounding, access, outreach and needs.

Figure 3. Input Articles Over Time **Source: Authors.**

Concerning the tools and approaches category of inputs, articles generally proposed Web-based platforms and techniques, while a handful were regarding software systems that did not require Internet connectivity. There was a great deal of heterogeneity in the problems that researchers chose to address in terms of their systems and portal designs, and how and why they tackled these problems (Table 3). For example, within the open government data application category (see Table 3), Suárez and Jiménez-Guarín (2014) were interested in creating a tool to inform political decisions, dos Santos Brito et al. (2014a) reported apps to support governmental

services like health care, while Capuano (2014) gave a rationale primarily in terms of a citizen's right to governmental information.

Table 2. Types of Tools

Tool Category	Frequency and typical example
Library Information System	9 <i>e.g.</i> Alam and Pandy (2012)
Open Government Data Applications	9 <i>e.g.</i> Fuentes-Enriquez and Rojas-Romero (2013)
Ensuring Environmental Sustainability	8 <i>e.g.</i> Kauppinen et al. (2014)
Disaster Alerting and Reporting	7 <i>e.g.</i> Frommberger and Schmid (2013)
Education tools and portals	3 <i>e.g.</i> Wu et al. (2013)
Others	7 <i>e.g.</i> See et al. (2015)

Source: Authors.

There were, however, no examples of participatory designs. This means that although research (as listed above) provided rationales for their tools in terms of solving a particular social problem, they typically did not conduct a needs assessment, or work with targeted users during the design phase of their research. At the same time, while there was limited evidence that researchers were engaging with poor and marginalized user communities in a participatory manner, many authors commented on the multi-stakeholder and embedded qualities of their work. For example, Iyengar et al. (2015) Amaral et al. (2014) both referred to the need for a greater diversity of actors to contribute to data and software workflows, and they acknowledged that tools require learning curves. They justified this cost in terms of collaboration benefits of developing common tools that benefit a wider population of people.

Semantic Web techniques and strategies were distinctly popular within the inputs group, and there were a range of articles that spoke about the processes and procedures needed to develop and maintain linked data-oriented tools (Kauppinen et al., 2014; Wu et al., 2013; Sarmiento Suárez and Jiménez-Guarín, 2014; Azevedo, Bastos and Parreiras, 2015; Han et al., 2015). Once again, these were often focused on the technical processes needed to instantiate tools and procedures (Martin et al., 2014; Ribeiro and Almeida, 2012; Arman et al., 2014), and evaluations were centered on semantic Web principles and standards (Sarmiento Suárez and Jiménez-Guarín, 2014; Brito et al., 2014b) and the quality of data from an internal consistency point of view (Tavares et al., 2012; Martin et al., 2014; Kauppinen et al., 2014).

There were only a handful of articles that proposed approaches such as a crowdsourcing approach to improving food security (van Etten, 2011), bottom-up practices in general (Bugs, 2014), and an open government evaluation model (Sandoval-Almazán and Gil-Garcia, 2014).

Within the group of articles related to infrastructure or institutional inputs, five argued that governments require a certain maturity level to implement open government data initiatives, and offered steps towards reaching such a level (Aryan et al., 2014; Rojas et al., 2014; AlAnazi and Chatfield, 2012). Within education, the language was rather about creating a supporting architecture and offered recommendations and advice on policy creation and and planning and implementation methodologies (Ochoa et al., 2011; Wright and Reju, 2012; Khanna and Basak, 2013). Relatively few articles generated discussion on infrastructure related to costs (Selviandro, Suryani and Hasibuan, 2014), Internet (Mtebe and Raisamo, 2014a; Odinma et al., 2011) and sustainability (Tagoe, 2014) even though within the next section, these were identified as major barriers to open development adoption.

Finally, considering the critiques explored in the introduction along with one of the primary narratives of open development related to access and inclusion, access and outreach was not featured significantly within this group of articles.

3.2 Mechanisms

Out of 80 studies (Figure 5) in the mechanism category, 47 (59%) articles investigated adoption factors of open models. 20 (25%) explored topics related to culture, politics and power, while 10 (13%) explored environmental and context conditions related to open development. 22 (28%) articles from the mechanism category were published in ICT4D journals with the majority focused on cultural, power and political mechanisms of openness.

Figure 4. Mechanism Articles Over Time

Source: Authors.

There were a number of articles within the education domain that examined adoption factors of open educational resources (OER). The majority of these studies approached the topic from the perspective of teachers with little discussion of their existing pedagogical practices, save for Long and Haklev (2011). The main barriers identified were legal factors (Kursun et al., 2014), quality of OER or how it fit into existing curriculum (Mtebe and Raisamo, 2014b), Internet and technology infrastructure (Percy and Van Belle, 2012), and lack of time and/or skills to find OER (Prasad and Usagawa, 2014). Mtebe and Raisamo (2014a) and Percy and van Belle (2012) found conflicting results related to performance and effort expectancy. However, credit towards promotion (Clements and Pawlowski, 2011), and willingness (Farisi, 2013) were found to be incentives for teachers. This could mean that intrinsic motivation and whether a reward system for teachers is experienced in a supportive or controlling manner probably makes a difference.

In terms of facilitating conditions, quality instruments, trust in searching the system and relationships with co-creators, and creating a supportive policy environment and sharing culture were explored (Clements and Pawlowski, 2011; Hou et al., 2013). In the Open Educational Resources Consortium of Chinese Universities (OERCCU) they adhered to strict quality norms (Hou et al., 2013) but this perhaps leads to a particular kind of OER system that is potentially open to use but less open to contribute to.

From student perspectives, unsurprisingly, studies reported findings related to learning processes. For example, that students use OERs when they are enriching, of good quality, and have the freedom or choice to use OERs in a self-directed manner (Harsasi, 2015; Hatakka and Lagsten, 2012). Hatakka and Lagsten's (2012) reflection points out that OERs will positively impact on students from marginalized backgrounds if they transform relationships between teachers and students, which means that the pedagogical strategy is a primary mechanism that

predicts the kind of transformation that an OER can contribute to. As previously mentioned, this has not been a main focus of OER research amongst teachers unfortunately.

Within crowdsourcing literature, theoretical constructs like perceived net gain, self-efficacy and outcome expectation were explored from participant perspectives (Sun et al., 2014; Zhou et al., 2014). Economic benefits, like whether people are motivated differently when offered money were frequent. Indeed Sun et al. (2014) showed differences in motivations depending on the type of virtual community and whether economic gains were in question. The type of task, task granularity and complexity were also moderating factors identified (Zhao and Zhu, 2014; Sun et al., 2015). Zou et al. (2014) showed that external rewards did not negatively affect creativity of crowdsourced work done. Only one study examined relationships between community and content related factors. Enjoyment, ideology, sense of belonging and altruism were found to be moderated by community processes, and reciprocity and self-development were moderated by content processes (Xu and Li, 2015). There were only a couple articles from a sponsor's perspective, with one of a crowdfunding initiative that showed that sponsors are more concerned with the achievement of the specifications rather than the timeliness of the output (Zheng et al., 2014).

Like crowdsourcing studies, adoption factors within open government or open government data (OGD) literature also focused on processes but typically examined community/organizational processes rather than individual motivations. Developing processes to find the connections between internal creators/maintainers and external user and community groups was key as a means to understand needs and the environment (Chattapadhyay, 2014; van Schalkwyk, Willmers and McNaughton, 2015). These findings also seem like important pre-cursors to technical findings related to prioritizing interoperability and developing open standards to facilitate multi-stakeholder interaction (Paroški et al., 2015).

Adoption factors of open innovation had to do with organizational characteristics like transformative capacity, organizational culture and managerial ties (Huang et al., 2015; Naqshbandi et al., 2015). Chesborough's (2006) definition of open innovation was widely cited and as such, these articles typically examined open innovation as the extent to which organizations made use of external ideas (inbound innovation) and shared their intellectual property with external actors (outbound innovation). Within this framing, interaction and managerial ties with universities and government were more supportive than ties with other companies (Naqshbandi et al., 2015). Integrative organizational cultures had a positive effect on inbound innovation but not outbound; whereas hierarchical organizations negatively influenced inbound and outbound innovation (Huang et al., 2015). Celadon (2014) showed that firm size in the Brazilian cosmetics industry predicted the capacity of organizations to take up open innovation, essentially because they could afford more resources to dedicate to it. This runs in contrast to the narrative of the assumed low barrier to entry of open models.

The environmental and context conditions identified as mechanisms spanned across these domains. A supportive policy environment was most frequently identified (Long and Håklev, 2011; Meetoo-Appavoo et al., 2013), followed by technical factors like standards (Liu, 2014) and platform openness (Melody, 2010). Oddly, stable funding sources were mentioned only by Long and Haklev (2011). These studies were considered as mechanisms instead of inputs because they provided empirical evidence of how and why these conditions contributed to desired outcomes rather than as a framework or model that has been proposed but not tested.

The adoption literature of this review leaves a lot to desire and to question. Crowdsourcing and open innovation literature was typically correlative and quantitative, but was concentrated on particular countries and communities, and usually focused on business outcomes. OGD and OER literature, while displaying interest in different outcomes of their research, tended to be descriptive and qualitative, and had more geographic spread and diversity making it unrealistic to generalize. However, the group of studies in the mechanisms category that investigated culture, power, and politics surrounding open initiatives provide essential insights into how and why such initiatives require greater attention to the dynamics between social and technical aspects.

A variety of articles highlighted differences in the social arrangements and motivations, and how local contexts influenced propensity to share and cultures of open sharing (Huang et al., 2013; Harvey, 2011). The power and position of actors to share their knowledge, what kinds of knowledge, or whose knowledge is valued were also shown to mediate open processes in different ways (Burns, 2014a; Harvey, 2011; Taylor et al., 2014). In many cases, these aspects contribute to ideology which ultimately shapes intent of actors within open initiatives including researchers (Buskens, 2011). Harvey (2011), Buskens (2011) and Davies and Bawa (2012) all argued for greater reflexivity, and to expose politics and power through collective learning.

Moreover, research showed that many interpretations of open models exist and frequently co-exist, sometimes in opposing directions, which indicates that how openness is framed and presented is an important mechanism. Mengesha (2010) is an example of an open source project implementation that draws all of these elements together. His study showed that perceptions of various actors were often different, but the powerful actors views dominated implementation processes due to their ability maintain control over the implementation strategy. There were also studies that demonstrated that participation and institutional logics underpin open models, and that these are perhaps a more influential mechanism than the type of openness, when considering the kinds of social and economic changes that can occur (Vásquez-Urriago and Coronado Escobar, 2014; Hayes and Rajão, 2011). The next section presents the evidence surrounding what changes have occurred and why.

3.3 Outputs

There were 95 articles in the output category (Figure 6). Outputs were grouped into different types such as efficiency and effectiveness measures (40 out of 95 or 42%), individual outcomes (5 out of 95 or 5%), wider development impacts (33 out of 95 or 35%), incidental or unintended outcomes (3 out of 95 or 3%), and evidence of new or imminent forms of development or development models (13 out of 95 or 14%). 34 (36 %) articles were published in ICTD journals with the majority (21 out of 34 or 62%) focused on development impact.

Figure 5. Output Articles Over Time

Source: Authors.

A common strategy to evaluate open initiatives was to measure the efficiency or effectiveness of the initiative against the initial objective; however, initial objectives were not usually related to wider development contexts or goals. There were many examples of improved learning outcomes through the use of OERs (Zeng et al., 2014; Kaneene et al., 2013). Adoption rates of open source software were also revealed, usually in the health and library domains, and confirmed lower cost as main driver for choosing OSS (Karopka et al., 2014; Aminpour et al.,

2014). Without reflection on why or why not openness makes a difference it is challenging to draw conclusions from these studies.

Studies in the area of open government were the majority of both the efficiency and effectiveness category and the development impact category. The results, however, are quite heterogeneous. Like the efficiency studies above, a number reported on whether initial objectives were obtained. Correa (2014) and Canares (2014) showed that governments examined were and were not compliant with transparency policies respectively, and Matheus et al. (2014) gave mediocre rating to Brazilian provinces based on Berners-Lee 5-star rating. Yet, these authors all made recommendations in terms of improving multi-stakeholder relations and interactivity, which leads to the conclusion that their effectiveness measures are not adequate. In terms of impact, there was evidence that governments in a few LMICs have created organizational structures to accommodate new open data policies, and that the availability of data has increased significantly. However, there were a range of studies within examined countries that reported no changes in relations between local organizations and local governments, or no changes in levels of citizen engagement (Canares, 2014; Raman, 2012a; Tavares et al., 2012). There was agreement that lack of awareness, lack of local technical expertise and understanding of available information and tools were reasons for lack of change.

Other issues were that many LMICs lack supportive policy environments, and focus too heavily on supplying data, without adequately considering sustainability models or citizen groups. van Schalkwyk (2013) produced an interesting example of how data suppliers formed impressions of target group needs and supplied different kinds of data to suit different audiences based on their perceptions. This means that open data can affect various levels of governance structures differently and to varying degrees, and perhaps in a more controlling manner than is usually assumed. Another strong example of the tenuous relationship between governance processes and open data was Raman (2012b) who provided convincing evidence that in the Indian context, open data itself needed to be interrogated because of the ways in which governments either do not have adequate information or provide false information. Canares (2014) likewise gave evidence that the value of providing data is diminished without parallel attempts to raise awareness and ensure that target groups are capable and interested in using such information sources. In these cases, as Gurstein (2012) has argued, OGD is not neutral and within LMIC contexts, the role that OGD plays in governance processes is considerably different and needs to be constructed rather than assumed. This means that the majority of design research focused on OGD tools in the inputs group were largely founded on false assumptions.

In terms of individual and broader development outcomes, there was one fascinating article by Lindtner (2014) that showed individual and community empowerment outcomes. She provided convincing ethnographic insight into how ‘DIY makers’ in China had redefined the concept of innovation within an oppressive and restrictive context. Thomas (2014) showed a transformation in community norms which ultimately led to changes in perceptions of individual roles and identities, but these were not evaluated in detail. There were also a number of studies, although limited in number, that did provide evidence of alternative and imminent forms of development that would not otherwise occur without open models. Burns (2014b) argued that profound changes in data collection, processing and visualization have created a new epistemology, and the potential for context aware applications (Liu et al., 2013). Specifically, within LMICs, we have seen the emergence of new forms of labour through micro-tasking and labour as leisure (Hossain and Kauranen, 2015). Others such as Morell (2011) identified a free culture movement, and that this movement has shifted from the fringes to all sectors. This observation is reflected by Stacey et al. (2015) who explored the appearance of an open paradigm for organizations along with a number of ICT4D methodologies akin to Loudon and Rivett’s (2011) model of active engagement and co-creation. However, considering the claims of open development presented in the introduction, the lack of impact studies relating benefits of open development to poor and marginalized people is problematic. The next section continues this argument.

3.4 Trends Across the Pathway of Effects

What is clear from this review of literature is the growing popularity of open development research and practice in LMICs as the overall number of articles has grown exponentially. From a disciplinary perspective, the even spread of open development studies across the three Inputs-Mechanisms-Outputs pathway suggests that lessons have been learnt from the growth of the ICT4D field, where the early focus was highly technological. However, by examining the approaches that researchers have taken and the ways that they view the role of ICT in society, it seems that there is a rather visible dichotomy within that does not seem to be diminishing.

Figure 6. The Role of ICT in Open Development Research

Source: Authors.

Although there are some discrepancies, there have not been significant changes in the past five years concerning the approaches and views that open development research has displayed (Figure 6). The year 2015 is not representative of the entire year as the data was collected in October. The codes were grouped to show how there is a relatively even split across the five years in terms of research that views ICT toward the social-embedded end of the spectrum versus the technological determinism end. However, there has been a shift within the mainstream between 2010 and 2014. In 2010, ICT4D journals accounted for over 70% of articles that displayed social embedded views of ICT. Later in 2013 and 2014, a greater number of journals have published open development articles with social embedded views of ICTs. The rather unsurprising detail is the predominance of conference proceedings within the research that displays technological deterministic views of ICT, as publishing culture within the technical disciplines prefer these publishing venues (Meyer et al., 2009). Nonetheless, given the wide range of approaches taken, making generalizations of overall impact and the mechanisms of change of open initiatives in LMICs is problematic due to the heterogeneity of research objectives, methods and standards of rigor of the studies. There are, however, important lessons to be learnt from this review relating to empirical problems identified and positive examples to highlight.

Across all domains and all types of open development, there was typically a severe neglect of poor and marginalized perspectives, and also gendered perspectives. On average, research did not target poor and marginalized people as participants, or consider marginalized perspectives as a means to conceptualize their research design. For instance, a variety of research included university students, professionals, and experts to participate in or to test initiatives (Ansal and

Yildirim, 2010; Murthy et al., 2014; Wu et al., 2013). Some articles made claims about the relevance of their work to ‘ordinary’ citizens without speaking to them or considering the actual Internet access restrictions ‘ordinary’ citizens face in these countries (Matheus et al., 2014; Nugroho et al., 2015). In the education domain, openness is argued to reach students who fall through the cracks (Tagoe, 2014), but typically research examined how OER can support inclusiveness for students already in attendance (Hodgkinson-Williams and Paskevicius, 2012; Shyshkina, 2015). Furthermore, adoption literature that sampled teacher perspectives demonstrated evidence of skewed demographics towards men (Okonkwo, 2012), there is a great need to discuss this pervasive inequality within educational institutions. Gender disparities in samples were also overwhelming in crowdsourcing literature (Sun et al., 2014; Xu and Li, 2015; Zou et al., 2014). There was one example of a study that shifted employment opportunity away from Mali and mainly to India after introducing micro-tasking as a means to improve efficiency of survey collection (Chen et al., 2012), it is worth considering how this could be harmful to some.

Clearly, as research presented within the mechanism stage of effect demonstrated, poor and marginalized populations have distinct needs and capabilities that are not being met through open development research in general. Nevertheless, the ICT4D community has generated significantly and proportionately more critical research focused on uncovering hidden power-dynamics and interests (in the mechanism category) and development impact (in the output category). Such research has contributed crucial insights into how open development can overcome inequality and marginalization; however, critical research continues to exist at the margins (37 out of 269 or 14%), and there were even fewer participatory research studies (6 out of 269 or 2%).

4. CONCLUSION

Certain broad albeit significant conclusions require further discussion, both in this paper, and more generally by the community. The first concerns the relationship and causality implied in the term open development. In fact, openness is in itself not development, nor does openness necessarily lead to positive development impacts, however defined, to a broad homogeneous population in need. While this work is formative in considering a range of perspectives on open development, further investigation is urgently required. This review suggests that work is progressing rapidly in all three perspectives encountered. We rigorously reviewed 269 articles spanning a myriad of domains and types of openness. The majority of the articles that we encountered presented tools, adoption factors and effectiveness measures within this area. We also uncovered empirical problems such that poor and marginalized people were typically not included in this area of research by design. A growing number of critical studies, notably within the ICT4D community have, however, demonstrated the need and value of approaching this research field with transformational aims as a main driver.

Therefore, when considering open development, it is worth considering, at this historical juncture, a common scope of reference, if not a definition. With expected growth within this area, we caution against continued self-identification of open development as a means of building the field. As the majority of research within this review does not claim to be doing, advocating, or assessing their contributions to ‘development’ per se, but instead operates within this arena, a clear research agenda for open development is lacking. If the ultimate aim of open development is transformational, we urge this community to debate and deconstruct the principles and limits of open development research within a common definitional frame. At least, as we have argued in this review, stating why or why not openness makes a difference, the expected impact of the initiative, engaging people as participants in the research, and critically reflecting on the mechanisms of change. We might begin with whether, indeed, open development is a thing.

5. ACKNOWLEDGEMENTS

This research was conducted as part of the Singapore Internet Research Centre’s SIRCA III programme and is funded by the International Development Research Centre (IDRC) of Canada.

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