Research Policy xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

Research Policy

journal homepage: www.elsevier.com/locate/respol

Public private partnerships and emerging technologies: A look at nanomedicine for diseases of poverty

Thomas S. Woodson

Dept. of Technology and Society, Stony Brook University, 341 Harriman Hall, Stony Brook, NY 11794, United States

ARTICLE INFO

Article history:
Received 19 May 2015
Received in revised form 17 April 2016
Accepted 19 April 2016
Available online xxx

Keywords:
Public private partnership
Emerging technologies
Nanotechnology
Diseases of poverty
Inclusive innovation

ABSTRACT

Emerging technologies, like nanotechnology, are often hailed as transformative technologies that will not only help the rich, but be used to decrease poverty and inequality. In order to overcome many of the challenges associated with developing products for poor communities, especially medicines for the poor, institutions setup organizations called public private partnership (PPPs). This study examines whether PPPs are developing nanotechnology to make medicines for diseases of poverty (DoP). PPPs are the main actors researching medicines for DoP and if they are not involved with nanotechnology research, then it is unlikely that nanomedicines for DoP will be developed. Through interviews and website content analysis, this study finds that there are only a few PPPs doing nanomedicine research. Many of the PPPs are worried that the technology is too expensive and it will take too long to bring nanomedicines to the market. To increase the likelihood that emerging technologies, like nanotechnology, will be used to mitigate poverty, policy makers can do several things like change the patent laws to encourage innovation on technologies for the poor, increase research funding in areas that address development, and move pro-poor technologies quickly through the regulation process.

1. Introduction

Many of the world's deadly diseases have been eradicated through a variety of technologies and social improvements. Some diseases were addressed by better medications, treatment regimens and vaccines, while other diseases were eradicated due to improved cleanliness standards that prevented pestilence from spreading. Despite the improvements in overall health, the advancements are not evenly distributed. Many medical discoveries only target diseases of the very rich and other medicines are too expensive for impoverished communities to purchase. At one point scholars estimated that there was a "10–90 gap" in health research because they found that less than 10% of healthcare research and development (R&D) was on diseases that affect 90% of the world's population (Murray et al., 2012). Today the gap is not 10–90, but there are many diseases that predominantly affect the poor that receive little R&D funding (Moran, 2005).

Most scholars identify about 40 disease of poverty (DoP) (Moran et al., 2010; World Health Organization, 2010) and the healthcare literature attributes a portion of global health inequality to the lack of a profitable market associated with DoP medicines (Chataway et al., 2010; Moran et al., 2010; Widdus, 2001). Scholars reason that biotechnology and pharmaceutical companies will not develop new medicines to target DoP if they cannot recoup their R&D expenses, and as a result, there is less R&D and medicines for DoP.

To overcome the small market for DoP treatments, scholars believe that it is necessary to develop special organizational structures called public-private partnerships (PPPs) (Chataway et al., 2010; Moran et al., 2010; Widdus, 2001). PPPs can improve the DoP medicine market by connecting pharmaceutical suppliers with customers and lowering the barriers to entry so pharmaceutical companies can develop and sell medicines for DoP. PPPs also provide research funds, link companies to government health organizations, participate in manufacturing and assist with distribution and marketing (Glennerster et al., 2006; Widdus, 2001). These efforts can spur drug development on DoP, make the current medicines more accessible, and lead to inclusive innovations.

One new health technology that some scientists believe will revolutionized healthcare is nanotechnology. Scientists hope medical applications of nanotechnology (nanomedicine) will lead to things like targeted drug delivery systems, nearly instantaneous disease detection sensors and stronger, yet flexible, prosthetics (Invernizzi,

E-mail addresses: thomas.woodson@stonybrook.edu, tswoodson@gmail.com

http://dx.doi.org/10.1016/j.respol.2016.04.005
0048-7333/

2006). However, nanotechnology, and other emerging technologies, only have viable futures if there is a market for them (Cozzens et al., 2010). If there is no market for a technology, then companies do not have an incentive to develop and sell them. Yet, the market for DoP medicines is unclear because companies are unlikely to recoup their research expenses and make a profit on medicines for diseases that affect the poor (Kremer, 2002). Therefore, there is an interesting intersection between PPPs, nanomedicine and inclusive innovation. According to current academic theory, emerging technologies, which could have an impact on the poor, will only be used to address DoP if a market exists. PPPs can help build and maintain a market, and as a consequence, entrepreneurs and scientists will use emerging technologies, like nanomedicine, for inclusive development (Glennerster et al., 2006).

This study investigates the role of PPPs for DoP medicine development and whether they are researching nanomedicine. It adds to the literature on PPPs by considering the extent that this organizational structure can develop emerging technologies for inclusive development. How do PPPs decide the types of projects to pursue? Do PPPs think nanomedicine is a viable field? Is there evidence of a relationship between PPPs and emerging technologies? I use a mixture of primary and secondary sources to understand the motivations of PPPs, their research priorities, and importantly, whether PPPs can overcome market deficiencies to provide emerging technologies for inclusive development. This paper begins by giving an overview of the relevant literature and the research methods. Then, I discuss the research findings and policy implications.

2. Literature review

2.1. Public private partnerships

PPPs are not new institutions; rather, governments have partnered with private organizations to provide public services for hundreds of years. For example, the Dutch East India Company was a partnership between the Dutch government and industry to encourage world-wide trade and during World War II, governments heavily relied on the private industry to provide supplies and services for the war movement (Wettenhall, 2005). Despite the prevalence of government and non-government partnerships, the term public-private partnership was first used about 40 years ago (Bovaird, 2004) and since then, it has grown in prominence. PPPs span sectors and have a variety of functions like policy design, policy evaluation and monitoring, implementation, capacity building, activism and resource mobilization (Bovaird, 2004; Brinkerhoff and Brinkerhoff, 2011).

One heavily cited definition of PPPs is "working arrangements based on a mutual commitment (over and above that implied in any contract) between a public sector organization with any organization outside of the public sector" (Bovaird, 2004). This definition is broad and it allows PPPs to have assorted organizational structures ranging from partnerships between national government agencies and companies to partnerships between local government departments and community group.

These type of organizations form for a variety of reasons. First, the complexity and interconnectivity of problems prohibit a single organization from accomplishing their goals, so in order to succeed, organizations must partner together (McQuaid, 2000; Van Ham and Koppenjan, 2001). The need to partner due to increased complexity is especially relevant for organizations working with highly scientific emerging technologies. These technologies are at the forefront of knowledge, and a variety of sectors must share knowledge in order to develop them (Cozzens et al., 2010).

A second reason that organizations form PPPs is that a group of organizations can better overcome market deficiencies than a single actor (McQuaid, 2000; Van Ham and Koppenjan, 2001). For example, some innovations have high technical risk that prevent them from being economically attractive, while other innovations have low monetary return. PPPs can circumvent these barriers by spreading the risk of failure over multiple parties and projects (Greve, 2006).

Partnerships also improve the economies of scale of R&D and pool talents across different sectors (Bovaird, 2004). Most health PPPs have expert scientific boards from industry, academia and non-profit organizations that assist managers to choose research portfolios that align with the goals of the organization. The boards' consider the cost and feasibly of projects to decide whether to pursue them (Munoz et al., 2015). In contrast, independent organizations may not have the personnel and financial resources to manage, evaluate, and implement multiple highly technical projects (Moran et al., 2010).

However, not all scholars think that PPPs are beneficial for inclusive development. Miraftab describes PPPs as Trojan Horses that hide unequal power relationships and lead to community partners being marginalized by the dominant partner. Asymmetric power relationships are especially prone to occur with low-income communities because poor constituents have fewer resources to make their voices heard (Miraftab, 2004). Rather than thinking of PPPs as a panacea to problems, Miraftab suggests that PPPs focus on improving social, economic and cultural conditions (Miraftab, 2004). Simply forming a PPP does not guarantee equitable outcomes.

Since there are so many types PPPs, this paper focuses on a subset of PPP's called product development partnerships (PDPs). Chataway et al. defines PDPs as a "technology push initiative aimed at providing new science and technology based products for neglected diseases" (Chataway et al., 2009). The majority of health PPPs/PDPs began around 1999 (Munoz et al., 2015; The Economist, 2013), and at that time, several factors converged to create a public buzz to address DoP. In 1999, there was substantial public outrage directed at pharmaceutical companies because they refused to provide low-cost HIV medicines to victims in poor countries. In response to the negative publicity, many of the big pharmaceutical companies began researching medicines for DoP and giving their technology to researchers working on these diseases (The Economist, 2013). Moreover, in 2000 the United Nations launched the Millennium Development Goals (MDGs) and increased the visibility of DoP. This made the world community more responsive to the needs of the poor and it put public pressure on countries to find solutions for these issues. Similarly, celebrity activists, like Bono and Angelina Jolie, and large non-profit organizations, like the Bill and Melinda Gates Foundation, highlighted the importance of global health and many of these activists viewed PPPs as a the vehicle to leverage the advantages of the private sector to address poverty issues (Cohen, 2006).

PPPs are now the principal organizations developing medicines for DoP (Grace, 2010; Moran et al., 2010; Munoz et al., 2015). Moran estimates that in 2004 75% of R&D projects for neglected diseases were conducted by PPPs (Moran, 2005) and that 14 PPPs spent $262 million on neglected disease R&D in 2007 (Moran et al., 2010). In addition, by 2010 PPPs brought 10 new health products to market and it had another 122 treatments in the pipeline (Grace, 2010).

Health PPPs are described as " 'system integrators' that leverage the resources and capabilities of a network of a public, philanthropic and private sector partners" (Munoz et al., 2015). Chataway et al. find that prominent PPPs are knowledge brokers and integrators that drive innovation, stimulate R&D and negotiate among other organizations in the biomedical research innovation system (Chataway et al., 2007). However, previous studies do not investigate whether PPPs actually develop emerging technologies for poverty alleviation and there is some doubt that PPPs can really

Please cite this article in press as: Woodson, T.S., Public private partnerships and emerging technologies: A look at nanomedicine for diseases of poverty. Res. Policy (2016), http://dx.doi.org/10.1016/j.respol.2016.04.005