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Social contexts can shape health technologies; fallacy or fact?

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Scientific research has in some cases, provided solutions to rid populations of disease but these are often not made available to poor people in developing countries. During an Innogen study of a number of different areas of scientific research related to diseases of the poor we identified three types of mismatch that take place impeding the successful discovery, production and delivery of new health products needed by the poorest populations of the world. The first relates to issues of cost, the second to the technical requisites of a solution and third to failures in delivery. In this paper we take the mismatches relating to failures in delivery at the most downstream of levels. We particularly refer to the social issues affecting successful delivery. These include lack of well designed social technologies, lack of political will, poor understanding of what people want or can use, and incomplete or disrupted organizational processes and institutions. These have implications for decision making and the creation of value chains for successful delivery of health products. Therefore, success in these areas can be described as the overcoming of some, or all, of these kinds of obstacles. We use the example of bednets; these mosquito nets are an example of a technology that is relatively simple to produce and potentially readily available. However, lowering disease burden due to malaria related illness using bednets is still difficult despite huge strides that have been made in some countries or communities. This is because bednets have a complex value chain that needs to be intact and to work smoothly in order for effective scale up to take place. The production of bednets from a textile factory on its own is not enough. There needs to be reliable and affordable input supplies to these factories including the impregnation of the bednets with an insecticide in order to make them more efficacious (increasingly this is being done during production rather than at the point of sale or in the home). And yet, this still is not enough. The biggest obstacle appears to be the need for the right set of organisational and institutional mechanisms or 'social technologies' to be in place to enable effective distribution of the bednets and their regular use in homes. This paper argues for further research into the complex interplay of social contextual factors that require the development of 'social technologies' to enable effective delivery. This entails a focus not only on distribution issues, but also the recognition of the need for a complete 'enabling environment' that captures the interconnectedness between the various stages of the value chain in the innovation and distribution processes relating to health products and services.

Context

Scientific research has created situations where solutions exist to rid populations of disease yet often these solutions have not been made available or accessible to the majority of those who need them in developing countries. In recent years much has been done to improve access to HIV/AIDS and malaria medication as a result of scientific advances but also favourable changes in policy or commitment from private industry. Yet, for other lesser known diseases much still needs to be done (Hotez et al, 2009).

This is often because of a number of mismatches. For example, some vaccines or medical devices are too expensive (to buy, to apply, or both) hence the role of the Global Alliance for Vaccines and Immunisations (GAVI) which aims to increase access to vaccines and save children's lives through funding vaccine introduction programmes. In other cases solutions are rejected at an early stage of technological development or do not diffuse (even if they are accepted). The former is the case for many HIV/AIDS vaccine ideas while the latter was the case for female condoms. Finally, some solutions need infrastructures that are not in place to diffuse for instance, a cold chain, potable water or a constant energy supply.

From the above we can identify three main types of mismatch that take place. The first relates to issues of cost, the second to the technical requisites of a solution and third to failures in delivery. These can all be further broken down and differentiated to give greater understanding of their impact on success or failure of solutions to reach the poorest in society.

The first set of factors inhibiting successful innovation reaching the poor are often issues clustered around the matter of 'cost'. These can be cost issues affecting the public sector as developer, purchaser and/or supplier of an innovative product or process. Alternatively it can relate to cost issues affecting private users either as individuals as end consumers or patients or private firms who use supply inputs to provide a service or product.

In other cases it is not always a matter of cost but one of technical requisites. Often this relates, as outlined above, to diffusion issues relating to delivery infrastructure and its availability i.e. the importance of a strong cold chain for effective immunization programmes. However, at times it is also related to technical issues within what we could term the overarching 'research environment' or the more upstream activities within a product or process life cycle where it is taken from 'bench' to out of the factory door.

In this paper however we are mostly concerned with discussing mismatches relating to failures in delivery; and in particular, the social issues which affect successful delivery. These include lack of well designed social technologies, lack of political will, poor understanding of what people want or can use, and incomplete or disrupted organizational processes and institutions that make it difficult to ensure the correct decisions are made to create a conducive value chain for successful delivery of health products. Therefore, success in these areas can be described as the overcoming some, or all, of these kind of obstacles.

Social technologies

Conventional analyses on the mismatch relating to failures in delivery of health products and services have focused on the market failure argument: that the gap between production and delivery is as a result of inadequate or incorrect incentives and related mechanisms.

While these mechanisms are important, we argue that successful delivery is not so much a matter of simply access to technologies as defined through input or provision of necessary health products and services to a healthcare system; successful delivery of health products and services is predicated on a wider range of factors including the correct organisational and institutional environment. Or to put it another way “the mix of organisations as well as their institutional norms, values and culture within and external to organisations” and which we term ‘social technologies’ (Chataway et al, 2009).

The concept of social technologies enriches our examination of the social issues affecting delivery of health products and services. It encompasses the links and interactions between actors, the norms under which the interactions occur and the broader context including the values and culture in which the actors and the institutions are placed. The link between social technologies and the broader institutional and organisational environment is crucial to understanding the barriers or mismatches to delivery of health products and services.

The social technologies conceptual framework is useful for analysing health initiatives such as Product Development Partnerships (PDPs). Chataway *et al* applied the framework in their analysis of the International Aids Vaccine Initiative (IAVI) and the Malaria Vaccine Initiative (MVI). The PDPs were found to be organisational experiments that went beyond addressing the inadequacies of market failure; using the social technologies framework revealed the complex ways in which the PDPs emerged and evolved (Chataway et al, 2009).

As discussed below, the Tanzanian A to Z Textile Mills is an example of a social technology. The next section discusses the A to Z model and the factors that have contributed to its success. It illustrates that successful delivery (including use) of bednets is influenced by factors such as the way in which the value chain is organised; the interactions between the bednet users, the intermediaries and the manufacturers; the institutional framework including mechanisms such as the National Voucher Scheme; economic factors such as donor funding and the creation of a general enabling environment through policy interventions.

An examination of the A to Z model through the lens of social technologies allows us to identify and understand the interconnections between the social context in which A to Z operates. It enriches our understanding of the complex nature in which the physical technologies (bednets) are accessed by the poor and how this relates to the overall health system. The concept of social technologies provides a platform from which we interrogate the sustainability of the A to Z model and the relative successes that Tanzania enjoys with regard to use of bednets. We ask interesting questions that emerge from our social technologies – based analysis and suggest areas for further research.

The case of Tanzanian bednets

Mosquito nets, now often known as ‘bednets’, are an example of a technology that is relatively simple to produce and potentially readily available yet long term success of this technology in reducing malaria burden is highly debated. When treated with insecticide they are one technology within a portfolio of options that are promoted by the World Health Organisation for use (others include anti-malarial drugs for treatment and as presumptive treatment in pregnancy and indoor residual spraying) however there is persistent debate about the reliance on insecticide treated mosquito nets and particularly the more modern long-lasting versions (LLINs) as the mainstay of prevention strategies.

Half the world’s population is currently at risk from malaria with 109 countries endemic resulting in nearly a million deaths a year mostly in children under five (WHO, 2008). The severity of the malaria situation according to Wen Kilama, a public health expert from Tanzania, is similar to deliberating loading up seven large aircraft and then crashing them into Mount Kilimanjaro every day (Kilama, 2009).

Since the mid 1990s bednets have been put at the forefront of malaria control and prevention activities. 1998 saw the first Cochrane review (Lengeler, 1998; 2004) of insecticide treated mosquito bed nets for their impact on morbidity and mortality that comprehensively reviewed all existing studies (the first that received major attention being Alonso et al, 1991) while with the setting up of the Roll Back Malaria Partnership in 2008 insecticide treated nets became one of the four main strategies put forward to control malaria.

Yet while there have been many studies that highlight the effectiveness of firstly, insecticide treated nets and secondly, LLINs both in terms of increased coverage and from a cost-effectiveness perspective (Lengeler, 2004), there has been a lack of investigation regarding the innovation of bednets themselves. While efforts have been made by donors to promote investment and scaling up of bednet and LLIN production, the emphasis of these activities has been on the need for more bednets to reduce mortality and morbidity of malaria burden, rather than a focus on the innovation process and its economic implications more directly. This is despite debates at various times regarding the best way to design, manufacture and distribute first insecticide treated nets and now LLINs (Lengeler et al, 1996; Hanson and Lengeler, 2009; Kaplan, 2008).

Better understanding of the innovation process would provide a means to more effectively ensure greater uptake and use of LLINs and so potentially positively impact disease burden. This is because bednets, just like more ‘high tech’ prevention methods such as a malaria vaccine, have a complex value chain that needs to be intact and working smoothly in order for effective scale up to take place. This moves beyond simply considering scale up in terms of delivery defined as ‘effective distribution’ (c.f. Hanson and Lengeler, 2009; Magesa et al, 2005) but considers scale up more holistically from initial invention stages through to use over the bed. Thus, simply starting after production of bednets in a textile factory on its own is not enough. There needs to be reliable and affordable input supplies to these factories including at some stage the bednets being impregnated with an insecticide to make them more efficacious (increasingly this is being done during production rather than at the point of sale or in the home). In this way the biggest obstacle is not the technology itself but

the need for the right set of organisational and institutional mechanisms or 'social technologies' to be in place to enable effective innovation and distribution of the bednets and their regular use over beds in homes.

Tanzania is one example often used as a success story in improving access to bednets and reducing malaria burden. Tanzania has its own indigenous bednet manufacturers (one of whom is now producing huge quantities of the latest long lasting insecticidal bednet) and has benefited from very active social marketing campaigns to promote the purchase of bednets and in recent years promoted bednet use through a voucher scheme run through antenatal clinics. The result is rising figures of bednet use and findings that a mixed public-private approach to bednet delivery strategies is cost-effective (Hanson et al, 2009, Hanson et al, 2008; Lines et al, 2003; Khatib et al, 2008)

In particular, one firm in Tanzania is often singled out for praise. A to Z Textile Mills, which started production of mosquito nets in 1998, has become the largest manufacturer in Africa and is a dominant international player since it teamed up with Sumitomo Corporation (with venture capital from the Acumen Fund and partnership input from donors and not-for-profits) to produce an LLIN. It has ensured improved access to LLINs for local people as well as improved employment opportunities for those living near the factories (employment numbers have more than doubled since the partnership with Sumitomo, Acumen and others was announced and is made up mostly of female workers). A to Z also provide nets for the international (particularly donor driven) market. It is expected that 20 million LLINs will be produced in Africa from 2009 many of these coming from A to Z's factories in Tanzania.

The Tanzanian bednet story is also one of success in terms of overcoming distributional issues beyond the factory door. Part of A to Z's success is due to the fact that there has been a ready market for their products. For the most part A to Z's nets have been sold through the public-private partnership that it is part of and not on the open market (Karugu and Mwendwa, 2007). In Tanzania especially the bednet manufacturers have benefited from a large scaling up effort in distribution of bednets through a National Voucher Scheme whereby women attending antenatal clinics receive a voucher to claim a subsidized bednet purchased in participating commercial shopping outlets. This builds on several previous social marketing projects of subsidized bednets with insecticide sachets. The result is that bednet coverage has soared in recent years in Tanzania. In just one year sales of ITNs expanded by 34% from 2004-2005 as a result of the voucher scheme (Brown, 2006). Yet even in Tanzania where bednet coverage is high, bednet coverage is still low overall at around 30% (Natnets, 2008) but higher than 1999 figures of less than 10% (Brown et al, 2008)

Yet, even with such success, more analysis is needed to understand the long term implications of this delivery approach which depends heavily on donor funding. Can bednet use be sustained and more particularly, re-treatment rates upheld? What happens when LLINs have reached the end of their 'life' at 3-5 years? Particularly, these questions are important when the price of the nets (around US \$5) is still out of reach of many people unless they receive a subsidized option or are provided them for free.

Furthermore, bednet manufacturers in Tanzania have benefited but to what extent has their market become long lasting and sustainable? In Tanzania lobbying by the industry and donors have resulted in the creation of an 'enabling environment' to support industry and bednet distribution (Magesa et al, 2005) through supportive tax structures and creative distribution systems. However, will the market be sustainable should donor funds dry up; can it survive without either venture capital input to the production side or guaranteed net purchase for subsidized or free distribution on the other? And what does A to Z's dominance of the African market do to the chances of other indigenous companies? Can they also be supported to upgrade to LLIN technology and what are the consequences of this? These challenges highlighted in report on Netmark, a USAID project to promote production and distribution of bednets and LLINs, appear yet to be overcome:

"Challenges still lie ahead. Public policy must continue to support ITNs and a role for the commercial sector; free and subsidized ITN programs must be fully targeted to the poorest and not totally undermine commercial investments; NetMark and partner marketing efforts must continue to build sustainable demand; and NetMark's commercial partners must expand their investment in ITNs to replace the support provided by NetMark. Under these conditions, the ITN market will continue to grow while serving the public health fight against malaria." (AED, 2005)

And more practically there are issues on the production and design of the nets themselves before we even reach the factory. This is particularly the case in terms of innovation of the insecticide technology and its binding to the nets as highlighted in a 2006 All Party Parliamentary Malaria Group report. They reported that there was a difficulty to meet demand with present production levels (due to the difficulty of transferring the technology/capacity to supply LLINs) and that:

"In general it seems that currently little attention has been paid to mechanisms to support and encourage research in this area. There may be a perception that industry is already doing enough without need for further incentives from the public sector. The market for products such as ITNs may already be large enough for private companies to feel it worth investing in R&D to a certain extent. However, it is important that research does continue in this area, and if a situation arises where the private sector alone is not carrying out enough to meet this need, then incentives and mechanisms to encourage R&D will need to be put in place." (APPMG, 2006: 48)

Discussion

The questions raised need to be answered but as yet, they have received little critical analysis by scholars or practitioners. They are important questions because they highlight the interconnected nature of social context, social technologies and physical technologies and the difficulty of determining success as the result of either a forward or backward linkage between, on the one hand, society, and, innovation of a physical technology, on the other.

Take the issue of bednets. In an environment that in terms of the innovation or research activities around bednets relies on donor or venture capital funding, there is also a similar reliance at the delivery or distribution level (for example through Global Fund purchasing of bednets for distribution i.e. through voucher programmes). Will it be possible to remove donor funding of such programmes if we want to meet the malaria prevention targets that we set ourselves?

However, perhaps we need to look at the question from a slightly different perspective. What economic impact will promoting a local textile industry have? Are we able to promote sustainable local business at the same time as meeting public health goals? Often this is the argument used when people talk about the success of Tanzanian bednet manufacturers. But what evidence do we really have, particularly as most current studies only pursue the issue from a public health perspective. This is an area that needs further research.

In proposing a research agenda here, we are acknowledging the importance placed on scaling up – defined in terms of sustainability – within certain circles. Thus what is important are what we have termed “technologies for health systems strengthening” (Chataway et al, 2009; <http://thesys.open.ac.uk>). The starting point becomes a more holistic one that does not simply see health products and technologies as inputs into the healthcare systems of developing countries but recognises the interconnectedness between the two ‘systems’ of innovation (of bednets) and healthcare (through bednet distribution as a malaria prevention mechanism) and appreciates that both need to be supported through a focus on the social as well as the innovative in order for technologies to be successfully – and sustainably – developed, applied and used to ensure healthy societies.

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