BETTER IMMUNIZATION DATA
INITIATIVE

Better Immunization Data (BID) Initiative Scale Theory of Change – Literature Review

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BID Scale Theory of Change (ToC) - Literature Review

Introduction

The Better Immunization Data (BID) Initiative (http://bidinitiative.org/) has a vision to empower countries to enhance immunization and overall health service delivery through improved data collection, quality, and use. The goal is to design a replicable and sustainable solution by taking an approach that brings together information system products, data management policies, and the practices of people that use them, to be tested in a few countries and packaged to deploy at scale in many. The BID Initiative also has embedded within it a peer learning network (the BID Learning Network (BLN)) that is intended to accelerate diffusion of knowledge, ideas, lessons learned, and innovations arising out of the BID Initiative activities and that of other entities involved in similar endeavours. This literature review is intended to support the development of a theory of change model that will enable effective monitoring and evaluation of the activities related to the goal of scaling up, and will review theories of scaling, peer learning, networking, and diffusion.

This review is focused on Outcomes 3 and 4 of the BID Initiative:

- **Outcome 3:** Achieved national implementation of the BID solution in one demonstration country, implementation of components of the BID solution in two other demonstration countries, and commitment toward implementation in 5-8 other countries within Sub-Saharan Africa by 2018.
- **Outcome 4:** Significant additional resources are committed from donors, multilateral agencies, implementation organizations, or other innovative sources for financial and technical support to countries adopting and improving the BID solution by 2018.

Theories Related to Scale

“Scaling up” is the process by which health interventions shown to be efficacious on a small scale and/or under controlled conditions are expanded under real world conditions into broader policy or practice (Milat et al., 2013 & 2014a). Decisions to scale up interventions are typically subject to iterative policy or practice-based decision making processes, usually including internal and external stakeholders. While policy makers may lead the process, funding agencies and political leaders play a pivotal role, and this latter group must be persuaded of the relevant merits of the intervention before any action can proceed (Milat et al., 2014b). Key issues requiring information to enable decision making regarding scaling up include effectiveness, reach, costs of operating at scale, and key service delivery issues such as acceptability, fit of interventions, and delivery models (Milat, 2014b).

Proof of Concept

It is inevitable that funding agencies and governments require tangible evidence of health interventions before undertaking to commit the considerable resources required to scale up such interventions. As noted by Shelton (2014), it is not just a matter of whether it works but whether it will work at scale within a specific context (Shelton, 2014). Public health decision making requires evidence of effectiveness and decision makers need to answer the 'how', 'when', and 'why' questions regarding an intervention before they can make a decision to go to scale. Of necessity, public health operates at scale in widely diverse and complex situations, and a key conceptual backbone is a detailed 'theory of change' to apply appropriate evidence for each operational component (Shelton, 2014). This evidence is drawn from activities using a variety of methodologies across different settings, and such evidence must be of high quality. The fact that the real world is complex and there is situational variability makes it necessary to triangulate evidence using different methodologies and to have sufficient data to make meaningful decisions about scaling up (Shelton, 2014). Going to scale is costly and resource intensive, making a viable proof of concept a general requirement for any public health intervention that is to operate at scale (Nice, 2011; Chamberlin, Efron, and Moore 2015).

In addition to requiring a proof of concept, Yamey (2012) identified specific barriers to scale up in low and middle income countries including; simplicity of interventions, the need to equip "scale up leaders", identifying health workers dedicated to scale up, reaching and engaging communities, matching the best delivery strategy to the specific health problem and context, and the need to raise the low profile of implementation science (Yamey, 2012). All these factors should be considered in the process of generating a proof of concept that is required to convince authorities in these countries to go to scale with interventions.

Aside from providing a proof of concept, there are other challenges to scaling up. A key challenge is that scale up will not occur overnight, but rather it often takes years. As time passes, financing priorities by government and international financiers may change, governments may change (with the possibility of change in policy), and agency managers and staff may move on (Hartmann and Linn, 2008). These authors propose that pilots should be designed with scale up in mind and the whole approach to scale up must be systematic in understanding that this is a dynamic process which takes time. This process needs leaders and champions who are in for the long haul (Hartmann and Linn, 2008; Chopra, Daviaud, Pattinson et al., 2009). These leaders and champions should be visionary, persistent, well connected to major stakeholders and constituencies, and able to build up authority and provide guidance (Hartmann and Linn, 2008).

BID Initiative approach: To address some of these issues, the BID Initiative has adopted a user-centric approach to design which has an embedded process of iteration at all levels of the health system based on user testing and feedback, with a view to arriving at a final packaged solution that engages all levels.

User-Centered Approach

User-centred approaches for the development of health information systems (HISs) are not new and have been shown to be effective when the user is an active participant in the development process (Pilemalm and Timpka, 2007), fully participating in various iterations of the innovation/product. Key challenges with this approach include unwillingness of users to engage in project initiation and information flow analysis, preferring to leave it to the experts (Doll and Deng, 1999) and the additional time and human resources required. However, the importance of involving users and engaging them appropriately has been underlined by Canada, Mortensen and Patnaik (2007). These authors posit that designs must be tailored to the priorities of each user group (innovators, early adopters, early majority, late majority, and laggards). This necessitates engaging end users at every level of the process from design to full blown adoption. In this respect, Everett Rogers' seminal work 'Diffusion of Innovations' (Rogers, 2003), is pertinent. A meta-analysis of 1840 studies related to Rogers' generalized theory of diffusion of innovations indicates that there is likelihood of these theories holding although for older studies there is a reduced level of scientific rigor (Midgley, 1987). An earlier empirical study (Baroudi, Olson, and Ives, 1986) demonstrated that user involvement in the development of an information system increases both user satisfaction and system usage, including satisfaction with information provided by the system. Finally, user involvement in design has been associated with improved quality of systems arising from more accurate user requirements, avoidance of costly system features that the prospective user neither wants nor is able to use, improved acceptance levels of the system, greater understanding of the system by the user which leads to more effective use of the system, and increased participation of the user in organizational decision making (Robey and Farrow, 1982).

Damodaran (1996) identified three levels of user involvement including informative, consultative, and participative, thus making a case for the latter arguing that participative involvement allows the user to influence key system design decisions and avoid the often observed shortfall in system abilities to meet expectations once operationalized. This literature review also emphasizes the need for infrastructural and management support for user involvement at different levels of the organization or system and stresses the point that user involvement should never become a rubber stamp process.

In addition to vision and drivers, Hartmann and Linn (2008) based on their research, state that interventions to be scaled up need 'space to grow' that includes financial, political, policy, institutional, cultural, partnership and learning space. Effective scale up requires diligent implementation of the intervention at every level of the health system and there must be accountability for service provision, otherwise there is a failure to deliver (Chopra, Daviaud, Pattinson et al., 2009). Connectivity and linkage between the different levels of the health system is therefore important for successful scale up (Oluwole et al., 2006).

Yamey (2011), based on qualitative research and an extensive literature review on scaling up health interventions, has identified key success factors that include choosing a simple intervention widely agreed to be valuable, strong leadership and governance, active

engagement of a range of implementers and of the target community, tailoring the scale-up approach to the local situation, and incorporating research into implementation. Further, this literature review highlights the importance of country ownership and of moving away from traditional donor-recipient relationships in which donors dictate the terms in the success of national scale up programs in Africa. There is emphasis on active, participative engagement of the recipients or targets of the intervention including government. This literature review, and others quoted therein, identify factors that are associated with faster diffusion including relative advantage (i.e. innovation addresses needs of adopter), compatibility, simplicity, triability (adopter has opportunity to try it out before adopting), and observability (innovation and its results are observed by the adopter). All of these are enhanced by early and sustained engagement with national governments (and other key players) to ensure alignment with government strategies and to ensure interoperability with existing and future systems (meeting the requirement for compatibility).

BID Initiative approach: The BID Initiative has consequently adopted the participative model for user involvement based upon these various theories.

Government Ownership

Mangham and Hanson (2010) discuss constraints to scaling up, highlighting policies and management at the health sector level as a constraint. Government is best placed to address these issues and if they are fully and continuously engaged, they have the ability to pave the way for both adoption and scaling up and are in a position to interact with other non–health governmental entities as necessary to ensure success.

Paina and Peters (2012) have emphasized the need to consider the complexities of the health system and view it through the lens of Complex Adaptive Systems (CAS). CAS are systems that have many interacting components with the capability to self-organize, adapt, and learn from experience. In this respect, the interconnectedness of different actors and their dynamic interactions across the health system closely resemble CAS. The authors therefore argue that organizational arrangements need to support the spread of access to health services. Health services in developing economies comprise highly heterogeneous groups of actors including policy makers, different categories of healthcare providers, managers, clients receiving services, regulators, collaborating partners, funding agencies, etc., and intervene at multiple levels through a variety of services and functions. This scenario requires strong government leadership and engagement for successful development, adoption, and scale up of solutions.

In their documentation of lessons learned in scaling up interventions in Africa, Larson et al. (2014) highlight the importance of government ownership and the need to communicate that the intervention is a government initiative (not a donor or partner driven initiative) to every level of the health care system.

Limited political commitment, shortage in human and financial resources, and unreliable data have all been indicated as obstacles to scaling up interventions that have been shown to work

(Kurowski et al., 2007; Prata et al., 2010). If government is going to own and prioritize an intervention, it must be aligned to that government's policy and priorities; and for scale up and sustainability, it is essential that interventions become part of the national health package and linked to targets and budget lines with a regular review procedure (Oluwole et al., 2006). National ownership has been cited as an important ingredient for successful scaling up (Oluwole et al., 2006). It is also important to ensure that from the start of any project, what constitutes "the intervention" is clearly defined and buy-in from government and implementers is critical in this regard (Larson et al., 2014).

Often, a critical limitation in undertaking scale up activities is cost – not just getting the money but determining how much is needed and making appropriate budgetary allocations (Johns and Baltussen, 2004; Alistar and Brandeau, 2012). Costs are specific to both the type of intervention and its particular setting (Johns and Torres, 2005). However, there are general principles that can be applied in determining these costs including taking into account the urban/rural dichotomy, distinguishing economies and diseconomies of scale, making distinctions between different types of costs, a thorough assessment of human resource capacity, and availability (Johns and Torres, 2005).

Theories Related to Peer Learning

From time immemorial education theorists and educators have challenged the teacher–led model of learning and in his 1916 book entitled democracy and education, John Dewey wrote: "Education is not an affair of 'telling' and being told, but an active and constructive process."(Dewey, 1916). Similarly, Paulo Freire in his book *Pedagogy of the Oppressed* (Freire, 1968) likened the traditional teaching framework as a banking system in which students are empty vessels in which knowledge and concepts are to be deposited. Views such as these have led to the evolution of learning theories that have sought to address the limitations of traditional models of learning. In the mid-1980s, Edwin Hutchins developed the theory of distributed cognition which states that "knowledge lies not only within the individual, but also in the individual's social and physical environment" (Hutchins, 1991). This framework encompasses the coordination between individuals and their physical environment. Distributed cognition alludes to practices whereby intellectual resources are socially shared, spreading individual cognitive resources and allowing groups to achieve more than a single individual can. These theories have given rise to what we now call "peer learning". Peer learning is not intended to be an outright rejection of the teacher-student hierarchy, but it does imply a strong personal commitment to your own learning and to your peers in a learning environment where all are co-learners. The theory of connectivity, expounded in a paper by Griffiths and Guile (2003), puts emphasis on the relationship between work experience, learning, and knowledge. Downes (Downes, 2006) went a step further and argued that the learning of knowledge is distributive, that is, it is not located in any given place (and therefore not 'transferred' or 'transacted' per se) but rather consists of the network of connections formed from experience and interactions with a knowing community.

From theory to objective evidence, the work by Kraatz (Kraatz, 1998) showed that social ties promote adaptation because they create high capacity information links between organizations and engender a motivation for information sharing; consequently mitigating uncertainty and providing benefits derived from insights and experiences of peers. Further, his work demonstrated that peers are more likely to imitate their successful peers rather than those that appeared to be different from them. The implication here is that if you bring equals together and sustain their interaction, they will be motivated to share information and learn from each other. Such a group if sustained, can grow into a community of practice, that is, people who are engaged in a process of collective learning in a shared domain of human endeavour, such as the case of the development of information systems that speak to timely availability of accurate data that can be used for decision making in immunization programs (Wenger, 2013). Rada (1998) in his review noted that collaborative learning is superior to individual learning as demonstrated in 226 comparative studies, and that cooperation and achievement are positively related. He further observed that self-critiquing is higher during collaborative learning (80%) compared to learning alone (20%). These attributes of peer learning result in better outcomes and enhance adoption of best practices among peers. Further, De Stobbeler and Ashford (2014) in their research demonstrated that peer enquiry is important and results in favourable outcomes, and that seeking feedback from peers is enhanced by task interdependence and psychological safety.

BID Initiative approach: It is the intention of the BID Initiative through its BLN, to support peer learning that will result in the emergence of a community of peers in Africa who share a common passion for immunization information systems that generate timely high quality data; data that can bring to fruition the fundamental goal of the BID Initiative, namely that countries' health services are empowered by improved data collection quality and use. An underlying principle of the BLN is that bringing equals together will motivate their sharing of information and learning from one another.

Peer learning networks take different forms, but the form that the BID Initiative is concerned with is cooperative learning where peers work together in pursuit of a specific shared goal within a structure that creates positive interdependence (Topping, 2005). Methods for peer learning vary on a number of organizational variables including from where participants are coming (e.g., different countries or institutions), place (location of operation), characteristics of whether they play the "helper" or "helped" role, or whether or not equal opportunity involvement is emphasized (where everyone functions as helper and helped) among other things (Topping, 2005). Other factors include context, objectives, and required frequency of interactions. A theoretical model of processes influencing peer learning effectiveness has been proposed by Topping and Ehly (Topping and Ehly, 2001) based on existing research. The key processes include:

- **Organization and engagement** – Goals, plans, individualization, interactivity, immediacy, and variety.
- **Cognitive conflict** – To reduce primitive cognitions and beliefs.

- **Scaffolding and error management** – Zone of proximal development (ZPD) (i.e., what a learner can do with guidance) management, information modulation, modelling, monitoring, error detection, diagnosis, and correction.
- **Communication** – Embodying and crystalizing thought into language, listening, explaining, questioning, simplifying, prompting, rehearsing, reviewing, summarizing, speculating, and hypothesizing.
- **Affect** – Motivation, accountability, modelling, ownership, and self-disclosure.

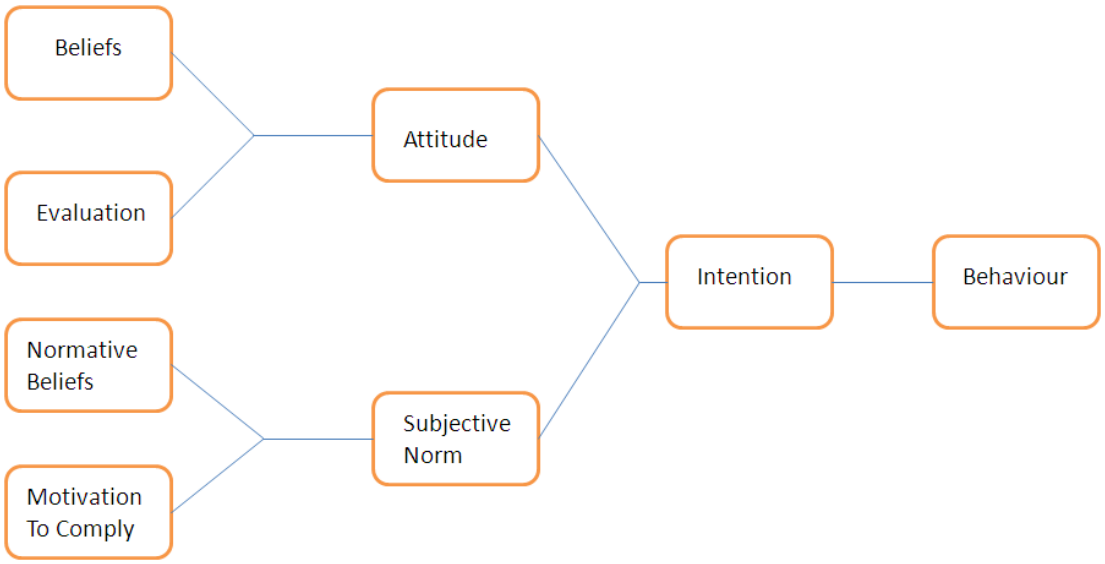
These processes lead to peers extending their current capabilities (accretion), modifying current capabilities (re-tuning), or rebuilding new understanding (restructuring). Ultimately this leads to a shared understanding between peers (Topping, 2005) and forms a foundation for further progress. Successful peer learning enables and facilitates an increased volume of engaged and successful practice resulting in consolidation, fluency, and automaticity of core skills, with the prospect of generalization of concepts learned from a specific situated example to varied contexts in multiple communities of practice. As this occurs, explicit and implicit feedback and re-enforcement occurs among peers where self- monitoring and regulation takes root. Metacognition, self-attribution, and self- esteem are expected to ensue when this happens.

Theories of Diffusion

Information systems (IS) theory and research leans heavily on Diffusion of Innovations (Rogers, 1995) and the Theory of Planned Behaviour (Ajzen, 1991). Diffusion of Innovations theory defines innovation as an idea, practice, or object that is perceived as new and diffusion as the process in which an innovation is communicated over time among the members of a social system (Rogers, 2003). Adoption is defined as a decision to fully use an innovation. Decision makers go through a number of stages from initial knowledge of an innovation to full adoption, and this has been called the “innovation decision process” (Rogers, 2003). Within this milieu, five characteristics of the innovation have been reported to influence the decision to adopt, including relative advantage, compatibility; complexity, triability, and observability (Tornatzky and Klein, 1982), and of these Tornatzky and Klein (1982) identified relative advantage, perceived compatibility, and complexity as the key elements influencing the decision makers’ propensity to adopt across the board (Tornatzky and Klein, 1982).

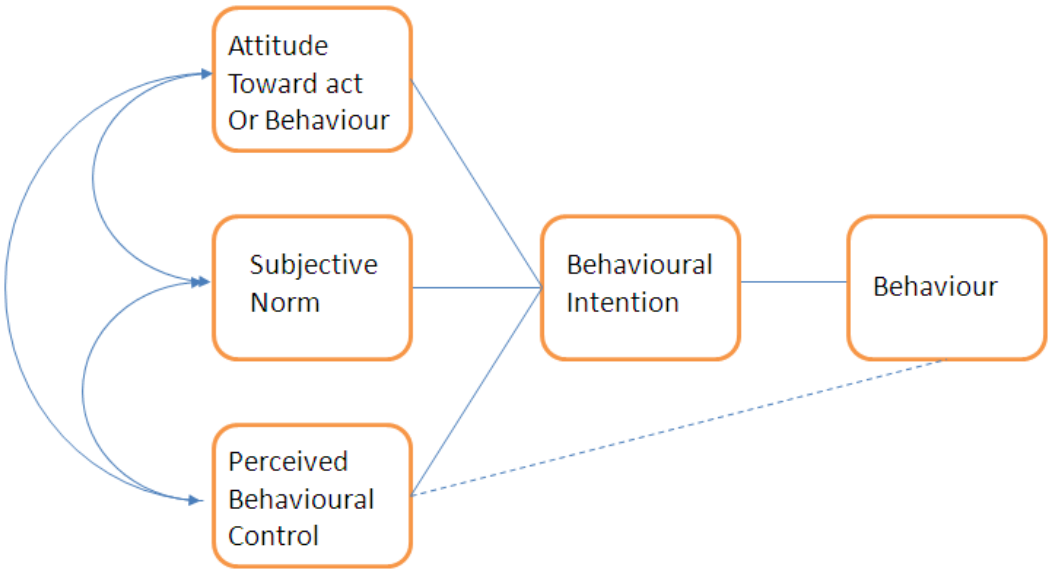
The Theory of Planned Behaviour (Ajzen, 1991) is based on research and expectancy value models (Fishbein and Ajzen, 1975) and builds on the Theory of Reasoned Action (Ajzen and Fishbein, 1980). The Theory of Reasoned Action is depicted in Figure 1.

Figure 1: The Theory of Reasoned Action (Imported from: Southey, 2012)



The Theory of Planned Behaviour, summarized in Figure 2, attempts to delineate the variables and iterations between those variables that are responsible for decision making behaviour. This model depicts that behavioural intentions are a function of the decision makers' attitude toward the behaviour, the referent subjective norms of the decision maker, and the decision makers' perceived control over the behaviour ((Weigel, Hazen, Cegielski, & Hall, 2014).

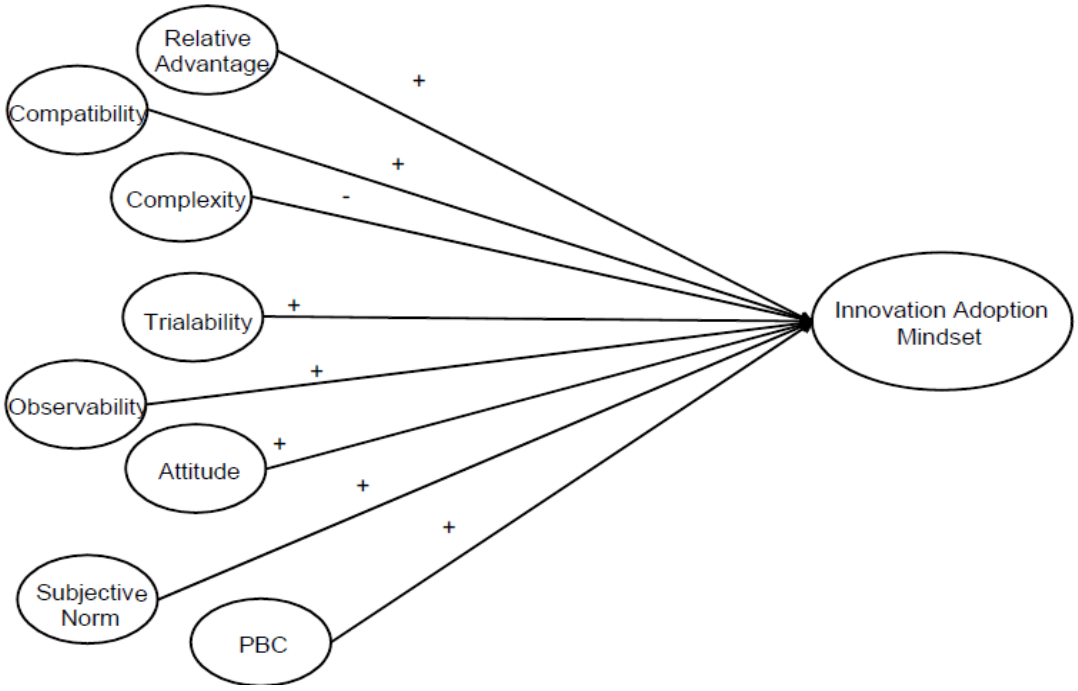
Figure 2: Theory of Planned Behaviour (Imported form Southey, 2012



Based on a meta-analysis of over 50 research studies, Weigel et al. (Weigel, Hazen, Cegielski, & Hall, 2014) have developed an Innovation Adoption –Behaviour (IAB) model which combines the Innovation Diffusion and the Theory of Planned Behaviour and have identified key factors

that affect the propensity to adopt and implement innovations, namely: relative advantage, compatibility, complexity, triability, observability, attitude, subjective norm, and perceived behavioural control as summarized in Figure 3.

Figure 3: Innovation Adoption-Behaviour (IAB) Model (imported from Weigel, Hazen, Cegielski, & Hall, 2014) NB PBC= Perceived Behavioural Control



In the IAB model, attitude toward behavior indicated the largest correlation with adoption propensity; the remaining elements except complexity, which had a negative correlation (- 0.28), were in the medium effect category (0.33-0.43), (Cohen, 1992).

One can conclude that the characteristics of an innovation as well as behavioral elements (as elaborated in the theories cited) are significantly correlated to adoption propensity, and are therefore important issues to consider in diffusion and in the design of theories of change.

The modelling and forecasting of the diffusion innovation has been researched intensively, and a review by Meade and Islam (2006) has made recommendations on forecasting new product diffusion where there is little data (often the case in many situations), as well as guidance given on model selection and forecasting for different scenarios including the diffusion of a single innovation in a single market, diffusion across several countries, and diffusion across several generations of technology.

The diffusion of a single innovation in a single country between introduction and saturation will be an “S” curve, and two extreme hypotheses explain this curve based on population dynamics. The three factors considered in deriving this shape are: (1) individuals are influenced by the desire to innovate (co-efficient of innovation, p); (2) a need to imitate others in the population

(coefficient of imitation, q); and (3) the proportion of adopters at time is [F (t)], such that the probability that a potential adopter adopts the innovation at time (t) is driven by [p+ q F (t)]. The sum of co-efficient of innovation and the coefficient of imitation (p+q) controls scale and q/p controls shape (must be greater than one to have an S shape) (Bass, 1962). Rogers (1962) postulated that as populations are heterogeneous in their propensity to innovate, initially the proportion of the population that adopts an innovation will be few (2.5%), followed by the early adopters (13.5%), then by the early majority (34%), then the late majority (34%), and finally the laggards in the rear (16%). This implies that people in a system have a threshold for adoption and that innovators have a very low threshold. However, as the innovation is adopted by more people, the social pressure reaches more thresholds. As individual thresholds for adoption are normally distributed, this creates an “S” shape of diffusion.

Diffusion of the same innovation across countries benefits from earlier adopting countries, in that historical data is available for predicting diffusion in later adopting countries (Mead and Islam, 2006). Norton and Bass (1987) proposed a modified model for diffusion across several generations of technology. The Norton-Bass model essentially asserts that each generation of innovation attracts incremental population segments of potential adopters and further, later generations may attract potential earlier adopters (Norton and Bass, 1987).

In as much as most of this theory emanates from the commerce sector, the health sector can adapt these principles to predict diffusion, understanding the underlying mathematical principles and population distribution patterns.

An emerging important factor in diffusion of innovations is the use of social networking tools such as Facebook and Twitter. There is growing evidence of the impact of social media on diffusion of innovations, and it has been documented that peer support or pressure and shared values influence people’s choices with respect to new innovations and choices (Mustaffa, et. al, 2011). For instance, peer popularization of the use of Facebook makes this a potential tool for rapid information diffusion through peer interaction such as content sharing (Zhan, Huaxia & Whinston, 2014). These authors provide some evidence for the effectiveness of social media as a tool for rapid exchange and spread of information. In addition, Cardon and Marshall (2015) have presented survey results that indicate that whilst businesses still mostly use traditional methods of team communication, the projection is that social networking tools will be the primary tools for team communication in the near future.

BID Initiative approach: An important role for the BLN is to support the diffusion of BID products, whether these be related to immunization information systems, practices, or policies. Of particular interest to the BID Initiative and the BLN is diffusion within a single country as well as across several countries. Based upon the various theories and learnings, the BID Initiative is investing in various communication tools to engender rapid information exchange and learning amongst peers.

Conclusion

Developing a theory of change for scale up will have to take into account the various aspects pertaining to interventions and implementers as elaborated in this short literature review. The documents cited herein on scale up interventions, identify key issues around scaling up. These include: the need to generate credible evidence for an intervention that can lead to the decision to go to scale, fitness for use of the intervention and its acceptability and ownership by the users, political commitment, leadership, and championship, connectivity and coordination at all levels of the health system, financing, and the learning that must happen. Further, with regard to the health workers and other implementers involved, the theories around peer learning and the appropriateness of the learning opportunities offered, and the adoption or adaptation of elements described in the theories of diffusion and planned behavior, need to be incorporated into the framework for facilitating the scale up of the BID Initiative's solutions.

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