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India's Technology Sector: Paving the Way for Innovative New Approaches to Healthcare

An Interview with Kanav Kahol

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India teems with innovation, and its healthcare sector is no exception. In this interview, NBR speaks with Kanav Kahol about India's culture of innovation and his observations surrounding an environment primed for the development of affordable health technologies.

Kanav Kahol, PhD, is Director of the Division of Affordable Health Technologies at the Public Health Foundation of India (PHFI). The division provides policy-level support for R&D in the healthcare sector; designs, develops, and evaluates affordable health technologies; and helps train a skilled workforce for the use of new technology. Prior to joining PHFI, Dr. Kahol was an Assistant Professor in the School of Biological and Health Systems Engineering at Arizona State University.

INDIA'S HEALTH TECHNOLOGY SECTOR: POISED FOR GROWTH

Q. What emerging trends do you see in India's health technology sector, and in what specific areas of health-related technologies and innovation is India taking a lead?

As a technology developer, I find India to be a wonderland. We produce a massive number of skilled engineers and IT professionals, and they have an immense hunger to be the best and the brightest. Over the past few years, India has emerged as a world leader in providing back-end IT services, but a slow revolution has been transforming our IT industry to become more product oriented. This is truly exciting from a technology development perspective.

Regarding health-related technologies, in the area of mHealth (mobile health), India is continuously innovating and providing state-of-the-art products. Across the country, there are several types of projects that leverage our growing mobile phone network and its reach to provide basic healthcare services. The first is telemedicine. For several years, our government has funded key projects that produced good foundational work on telemedicine's validity in delivering quality healthcare. Now, commercial players are entering the field. For example, Tata DoCoMo, a mobile services provider, now provides doctor-on-call services for a mere nine rupees per minute (roughly 18 cents). This is affordable for a large part of our population. With a large rural population in India, services such as this are going to be very exciting.

Additionally, there are several pilot research projects that deliver health communication to healthcare workers in the field through cell phones. For example, if confronted with a clinical case, such as delivering antenatal care, clinicians can direct treatment via a mobile platform and the healthcare worker can follow a checklist[1] that aids in delivering appropriate care. The software that enables this generally involves recording

1 Checklists lay out the essential steps that a health worker needs to take in order to correctly execute a given medical procedure.

the delivery of care and also supports the provider with a system to aid decisionmaking. In antenatal care delivery, phones for this purpose have simple software that requires the worker to input a mother's symptoms, family history, and test reports to determine whether or not the pregnancy is high risk. Similarly, mobile software also exists for services such as recording immunizations and point of care delivery through GPS tracking and pictures.

Q. What are the proven impacts and advantages of such mobile applications?

In repeated experiments, mobile software that supports best practices in the field has been shown to have a positive impact on health outcomes. These applications will enable enhanced, safe, and effective care delivery at the grassroots level. They already are in countries such as India, Nigeria, and South Africa, where software such as this is being developed and supported. I strongly believe in mHealth being the single biggest driver of "healthcare of the future." Several countries, India in particular, are conducting some amazing trials in this space, which will put them at the forefront of delivery of care over the next few decades.

INNOVATIONS IN AFFORDABLE TECHNOLOGIES

Q. Domestic research and development of technologies for health continues to expand in India. What underlying motivations or forces propel this culture of innovation?

The key in India lies in understanding the principle of "More features for Less money for More people" (MLM). This mantra, provided by a leading scientist in India, Dr. R.A. Mashelkar,[2] captures design philosophy in India. We have a population of 1.2 billion, and even though we are poised to grow to become the largest or second largest economy in the world by 2030, our per capita income is still going to be low. The only option is to develop products for less per unit cost that use economies of scale to provide services to more people, and to also offer more customized services.

MLM guides our markets, and it cannot be truer than in healthcare. There are several companies in India doing some amazing innovations like this. Low-cost devices such as affordable X-rays, ultrasounds, and CT scans, and also other innovations like ambulance tracking systems are examples of products that can substantially lower healthcare costs by providing effective service and reducing administrative costs.

Q. During your work on the Swasthya Slate[3] you said that India's work environment is highly optimized for the production of affordable technologies. What unique factors within India contribute to the ease and affordability of innovation in technologies for health?

I originally envisioned the Swasthya Slate in the United States, when I was a professor there, and had estimated that my budget was going to be $1.8 million with a development time of three years. In India, I was able to produce a prototype for $11,000 in three months. I still don't know how this happened. I think the main reasons are (a) the large number of trained professionals in India and (b) the existence of professional companies that specialize in electronic and computer-science oriented product design and delivery. The supply chain is easy to figure out if you know some local contacts and understand the Indian system. Having local liaisons I believe is critical to success here.

On a more fundamental level, we know our healthcare system doesn't work for millions of our population, and people are willing to go the extra mile to improve healthcare. When I would describe my idea of Swasthya Slate to the engineering teams, I could sense a spark and drive to go that extra mile. There is a common desire among most Indians to see rural populations receive the best healthcare.

Q. What steps can India take to further augment its position as an innovation leader at home and abroad?

Within the health technology sector, medical devices represent a $2 billion industry, and one poised to keep growing. But, the sector primarily serves areas other than India right now due to a regulatory structure that needs to catch up with the needs and demands of the Indian healthcare industry. Use of low-cost, innovative products in India will require a major overhaul. First, the system needs to clearly define and recognize more medical devices. Second, a clear process for regulation needs to be defined. Incentives need to be designed to

2 R.A. Mashelkar is identified with the culture of innovation in India. He is the former Director General of the Council of Scientific and Industrial Research (CSIR) and serves as Chairman for the National Innovation Foundation, the Marico Innovation Foundation, and the Reliance Innovation Council.

3 The Swasthya Slate, translated as "health tablet," is an Android-based computer tablet designed to interface a water quality meter, an electrocardiogram, a thermometer, and a heart rate sensor in a single device. It was designed in three months, and produced at a per-unit cost of $50. The slate will be given to 10,000 health workers in India.

encourage indigenous innovation. The good news is that the government recognizes the need for such changes and indications are that the upcoming five year period, which constitutes our 12th five-year plan, will have a strong institutional commitment to medical devices, regulation, and innovation. Currently, however, we are not seeing as much innovation in the adoption of medical technologies by India's healthcare system as we should. Given our capacity for technological innovation, this is a flaw we should and can address.

Q. What are the global implications for public health and for the technology industry more broadly of India exporting innovation?

India has the capacity to become a hub of healthcare innovation. Our innovations in mHealth will change how we deliver and monitor functions of the public health system. Additionally, diversity among Indian states is quite high; how the state of Bihar functions is very different from how Kerala functions. This diversity is a challenge, but from an innovations perspective, it allows us to develop models for different needs within India itself. This could be a hidden advantage as we look to globalize our products. A word of caution: I hope that countries, while of course striving to protect their populations against inappropriate and even defective devices and systems, do not let protectionist tendencies limit the use of innovative and affordable technologies. Further, countries developing affordable technologies have to ensure the highest efficacy and safety standards to let these disruptive innovations penetrate the world market.

GAMING AS HEALTH TECHNOLOGY

Q. Recently, gaming technology that involves physical activity for users has helped overturn traditional views of gaming as a sedentary activity. Has gaming been used as a health technology within India?

Perils of modernization include a sedentary lifestyle. Diabetes[4] and obesity[5] are at epidemic proportions in India. We know through studies[6] that exercise is the best method to control type II diabetes, but individual motivation to exercise remains a major issue.

While we clearly need well thought out measures that build better biking paths, walking paths etc., I am convinced that active games centered on popular Indian themes can be one of the tools to address the motivation gap in this country. Gaming is rapidly gaining popularity in India. Mobile gaming has caught on as a major activity amongst all population age groups (a case in point being "Angry Birds"). We now have the necessary buy-in to get started on using gaming as an intervention. It is necessary to take great care, however, to develop games around localized themes as well as to build on theories of health communication and health psychology.

Q. Can you provide an example of a game concept that uses a "localized theme"?

PHFI has envisioned several games that we believe could help populations use active games as a way of getting exercise by weaving exercise and healthcare into a story. One game idea, called *Saas Bahu aur Exercise* (Daughter-in-Law, Mother-in-Law and Exercise), exploits the immense popularity of daily soaps in India, many of which tell stories of mothers-in-law and daughters-in-law. The game requires two women to play-act as a mother-in-law and daughter-in-law who solve puzzles together, accomplish tasks, and even compete with another pair of players. The game will include several stages where physical exercise is required. In order to integrate good glucose control for diabetes, we will design the game to monitor blood sugar scores through USB glucose meters and use the scores to impart special powers or impediments in the game. This particular idea should be popular with all age groups, though especially women aged 25–50. We also envision a game, *Chalo Delhi* (Let's Go to Delhi), which would require users to drive a virtual autorickshaw around Delhi by running on a treadmill or bicycling while accomplishing various tasks that will include measuring the blood sugar or weight of the user to gain special powers.

Again, there is a huge cadre of animation engineers and artists in India that we will leverage to build such games.

4 The International Diabetes Foundation estimates that in 2011 there were 61, 258, 400 Indians with diabetes. That number is expected to climb to as many as 101,203,200 by 2030. See the (IDF Diabetes Atlas, 5th ed., October 2009, available at http://www.idf.org/atlasmap/atlasmap).

5 In India, World Health Organization (WHO) projects that 31% of males and 29% of females will be overweight by 2015. ("The Impact of Chronic Disease in India," 2005, http://www.who.int/chp/chronic_disease_report/media/india.pdf).

6 The Da Qing IGT and Diabetes Study, Finnish Diabetes Prevention Study, Indian Diabetes Study, and U.S. Diabetes Study all support physical activity as an asset in diabetes prevention.

ASIAN ECONOMIES AS INNOVATION LEADERS

Q. Is India's success in developing its own health-related technologies an example of a larger trend that is emerging within Asia?

From an innovations perspective, Asia is currently leading the way, and it is not just India, China, Japan, and Taiwan, but also economies like Indonesia and Malaysia that are taking the lead. Asia is definitely seeing capital inflows, higher growth rates, more stable governments, and an improving education system. All of these are foundations of a desire and ability to create and innovate. Further, as Asia becomes more prosperous, inequity and inefficiencies in healthcare are becoming clearer, and people are becoming less tolerant of them. This drives policy makers, technology developers, and the healthcare industry to focus on innovation. The Planning Commission[7] in India has declared that the next five years will see maximum focus on the healthcare and manufacturing sectors. Health technologies lie right at the intersection of these two focus areas. I feel very bullish about the prospects of Asian-style innovation leading health technologies into the new generation.

7 The Planning Commission was founded by the Government of India to promote its peoples' standard of living by effectively utilizing country resources. Their five year plans establish country priorities and lay plans for allocating resources accordingly.