
Technologie- und Innovationsmanagement

Working Paper

**Lessons from low-cost healthcare innovations for the Base-of the Pyramid markets:
How incumbents can systematically create disruptive innovations.**

Aditi Ramdorai
Cornelius Herstatt

June, 2013
Working paper No. 74



Technische Universität Hamburg-Harburg

Schwarzenbergstr. 95, D-21073 Hamburg-Harburg
Tel.: +49 40 42878-3777; Fax: +49 40 42878-2867

www.tu-harburg.de/tim

Lessons from low-cost healthcare innovations for the Base-of the Pyramid markets: How incumbents can systematically create disruptive innovations.

1 Introduction

The healthcare industry today is at a crossroads and every nation in the world faces healthcare challenges. Rich countries like the USA and Germany are battling soaring costs for healthcare and the long-term demographic challenges of an aging population, whereas poor countries like India are struggling to provide quality healthcare to millions.

Frugal innovations in healthcare are emerging from India, ranging from low-cost healthcare delivery by hospitals like Aravind Eye Care that provides cataract surgery to around 300,000 patients at a cost of 18 USD per patient (Rangan and Thulasiraj, 2007) to product innovations such as the Jaipur Foot, a low-cost prosthesis (Prahalad, 2004). Frugal innovations are characterized by their focus on affordability and retaining key functionalities of products/services (Prahalad and Mashelkar, 2010; Tiwari and Herstatt, 2012). These low-cost healthcare innovations not only provide access to millions who previously could not afford the product or service, but also have the potential to contribute to health care cost containment in developed markets and ‘disrupt’ developed markets (Christensen, et al., 2008; Howitt, et al., 2012).

Disruptive innovations, in contrast to sustaining innovation, initially offer lower performance in the key performance attribute but offer a secondary performance attribute, making it appealing to an emerging or a less demanding market segment (Christensen and Bower, 1996). Disruptive innovations are typically simpler, more convenient and more affordable (Christensen and Raynor, 2003). Disruptive innovations create growth potential for companies while opening up access to products and services that were previously beyond peoples’ reach (Christensen, 1997; Christensen and Raynor, 2003; Hart and Christensen, 2002). Low-income markets or Base-of-the-Pyramid [BOP] markets present new opportunities to Multi-National Corporations [MNCs] (Prahalad, 2004) and scholars are calling MNCs to leverage BOP markets to create disruptive innovations (Hart and Christensen, 2002). The healthcare industry is especially ripe for disruptive innovations because it has mostly focused on creating products and services for the Top of the Pyramid, to help solve problems that have not been solved before, and has not focused on making healthcare affordable and accessible (Christensen, et al., 2000).

Addressing the vast, fast-growing, 4-billion-people-strong segment poses unique challenges to MNCs and also requires new thinking in the field of international strategy (Ricart, et al.,

2004). Companies seeking to serve the BOP segments have to deal with market creation issues, working in informal economies with institutional voids and typically with broader and diverse set of partners (London and Hart, 2010) as well as internal organizational barriers (Halme, et al., 2012; Olsen and Boxenbaum, 2009). This is why MNCs have either failed to successfully enter BOP markets (Jaiswal, 2008) or have largely ignored them (Prahalad and Lieberthal, 2003). Similarly, established incumbents generally fail to successfully commercialize disruptive innovations. Their internal processes and values force them to focus on their existing customers, thereby ignoring projects targeted at new emerging markets that lack a customer base (Christensen and Bower, 1996).

An exception to this is the American incumbent GE Healthcareⁱ, which has been creating several frugal innovations targeted at emerging markets for the past years (Immelt and Govindrajana, 2009). In this research, we will look at organizational structures and processes that GE Healthcare has in place, which enables it to create disruptive innovations systematically. With this we hope to contribute towards building disruptive innovation theory (Christensen, 2006), where questions pertaining to selective success and failure of incumbents to create disruptive innovations remain unanswered (Danneels, 2004). Literature on disruptive innovations recommends incumbent firms to create a separate entity for commercializing disruptive innovations (Christensen and Bower, 1996). However, scholars have been calling upon firms to explore new markets and exploit existing opportunities simultaneously (Tushman and O'Reilly, 1996).

The ability to successfully drive disruptive innovations from within the organization will be analyzed through the lens of organizational ambidexterity. Ambidexterity is the ability of organizations to successfully balance exploration and exploitation. The manifestation of this act of balancing exploitation and exploration is the companies' ability to initiate multiple innovation streams, in this case sustaining innovations and disruptive innovations (Danneels, 2004; Tushman, et al., 2010). Key proponents of organizational ambidexterity, O'Reilly and Tushman, consider it a "solution to the innovator's dilemma" (O'Reilly and Tushman, 2008, pg. 202), however present their thesis only conceptually. This is a general gap in the research of organizational ambidexterity, as noted by scholars of organizational ambidexterity where consensus exists on the need for ambidexterity, but the underlying mechanisms and the 'how' remain undertheorized (Gupta, et al., 2006). This work will look at the mechanisms of ambidexterity at GE Healthcare to help explain its ability in successfully hosting sustaining and disruptive innovations from within its boundaries.

The next section will focus on the theoretical background of this research, explaining in greater detail the concept of disruptive innovation and BOP research. The next section describes the research methodology and research question. Section 4 narrates the empirical data from the GE Healthcare case study after which we analyze the main findings and close with a conclusion.

2 Theoretical background

2.1 Disruptive Innovations

Disruptive innovation, pioneered by Christensen through a series of scholarly work (Christensen and Bower, 1996; Christensen and Rosenbloom, 1995) and popularized by his seminal book, 'The Innovator's Dilemma' (Christensen, 1997), is considered by practitioners and researchers as "a powerful means for developing and broadening new markets" (Govindarajan and Kopalle, 2006, pg. 190). According to the theory, there are two types of innovations, sustaining and disruptive. To attain growth, companies improve product/service features that their mainstream customers appreciate through sustaining innovations.

Sustaining innovations thus improve the product along the primary performance dimension, which established customer segments value, in an evolutionary or radical manner.

Disruptive innovations, however, initially appear inferior from the perspective of mainstream customers but are appealing to emerging customers in low-end or new markets as they perform better on an alternative dimension. As these innovations improve over time, they overtake the existing technologies, by satisfying current market needs.

Christensen, in a sequel, replaced the term disruptive technology with disruptive innovation to include service and business model innovations (Christensen and Raynor, 2003). In this book, the authors further categorized disruptive innovations into two types: low-end disruption and new-market disruption. In case of low-end disruptions, the initial customers of the disruptive technology are price-sensitive customers at the low end for whom the low performance is acceptable. Low-end disruptions occur when current technologies are over-priced because their performance overshoots the performance expected by the market. Thus lower-priced alternatives with 'good-enough' performance have a chance to disrupt the existing technology. Alternatively, new-market disruptions "compete against non-consumption" as these enable new groups of people to begin using these products that previously lacked the resources or skills to use them (Christensen and Raynor, 2003, pg. 45).

Along with wide spread praise, the disruptive innovation theory by Christensen has also attracted criticism (Danneels, 2004; Tellis, 2006). The main criticism revolves around the lack

of a comprehensive definition of disruptive innovation and predictive use of the theory. However, this theory is still evolving and significant opportunities exist to contribute to theory building (Christensen, 2006).

2.1.1 Disruptive Innovations and Base of the Pyramid markets

Base of the Pyramid refers to the lowest socio-economic segment in the world. The World Resource Institute defines the BOP segment as people with an annual income in 2005 PPP terms of less than USD 3260 (Hammond, 2010). Since roughly over a decade, companies have shown growing interest in serving the BOP markets. Proponents C.K. Prahalad and Stuart Hart (Prahalad and Hart, 2002) argued that MNCs the world over should create products and services for the 4 billion strong low income markets, that MNCs traditionally have tended to ignore. The authors positioned this approach as having two key advantages: Firstly, it meant creating new profitable revenue streams for MNCs as they enter largely untapped markets. Secondly, they viewed it as a new market-based approach to poverty alleviation.

The BOP market is in no way homogenous and large populations, e.g. about 80% of Asia falls into this category (Hammond, 2010). The ‘bottom billion’ (Collier, 2007) or the poorest 1 billion people of the world live in subsistence and cannot be considered a “market” for MNCs (Jaiswal, 2008). However, there are still large parts of low-income segments, which are growing and have considerable purchasing power that can be of interest to MNCs. These segments that make up the mass markets of countries like India and China have been neglected by MNCs until recently, who have chosen to concentrate on the small number of elite in these countries (Prahalad and Lieberthal, 2003). The BOP approach, targets these unaddressed markets and is recognized as a key emerging frontier of international business strategy research as it requires fundamental rethinking (Ricart, et al., 2004).

The BOP market is an ideal ground for potentially disruptive innovations (Hart and Christensen, 2002; Prahalad, 2011). One of the characteristics of disruptive innovation is that it attracts non-consumers or low-end customers that are satisfied with “good-enough” performance. BOP markets have vast populations of people with limited or no access to services and products who are willing to adopt affordable products with acceptable performance (Hart and Christensen, 2002).

Disruptive innovations initially take root in nascent segments and non-mainstream markets (Christensen, 1997). The BOP markets are nascent markets for MNCs and were, until recently, ignored by them since people from the BOP don’t have the kind of buying power that developed markets do (Prahalad and Lieberthal, 2003).

Disruptive innovations are typically simpler and are offered at a lower price (Christensen, 1997; Govindarajan and Kopalle, 2006). Creating products and services that are simple and affordable to low-income segments is most crucial for adoption and success in the BOP (Anderson and Billou, 2007; Prahalad, 2004). Such models created for the low-end can be profitably applied in the high-end as well (Hart, 2010). Thus products and services that succeed in BOP markets could be disruptive to dominant products and services in the higher-end of emerging markets as well as developed markets.

These three attributes of the BOP mentioned above make BOP an ideal market for launching disruptive innovations, namely, vast numbers of non-consumers, disregard by MNCs and need for simple and affordable products.

2.1.2 Challenges in commercializing disruptive innovations

Prior research points to how established firms stumble in the face of technological change (Foster, 1986; Henderson and Clark, 1990; Tripsas and Gavetti, 2000; Tushman and Anderson, 1986). Technological discontinuities that were competence destroying (Tushman and Anderson, 1986) or ‘architectural innovations’ (Henderson and Clark, 1990) presented established companies with challenges that led to serious shifts in the industry. Disruptive innovations present another manifestation of this phenomenon, but have different characteristics and other reasons why established firms fail to commercialize them (Christensen and Bower, 1996).

Two inherent qualities of disruptive innovations differentiate them from other discontinuous innovation.

1. Lack of financial attractiveness: Christensen argues that disruptive innovations appear financially unattractive for companies to pursue (Christiansen, 2006), relative to their mainstream investments for three main reasons:

- I. Profit margins for disruptive innovations are typically lower (Christensen, 1997)
- II. Companies are unable to correctly estimate the size of the market for disruptive innovations since these innovations create completely new markets (Christensen and Raynor, 2003).
- III. Companies tend to pursue large markets. Initially markets for disruptive innovations are much smaller than mainstream markets and cannot provide volumes that make the business interesting for companies (Christensen, et al., 2001).

2. Incompatibility with existing value network: Christensen uses the concept of value networks to explain attacker’s advantage in commercializing disruptive innovations

(Christensen and Rosenbloom, 1995). Value networks are defined as "the collection of upstream suppliers, downstream channels to market, and ancillary providers that support a common business model within an industry" (Christensen, 1997). Disruptive innovations do not fit into the embedded value networks of the organization and new market disruptive innovations typically create new value networks with new performance attributes (Christensen and Raynor, 2003).

These inherent qualities of disruptive innovation make them unattractive for established firms and they often fail to commercialize disruptive innovations (Christensen and Bower, 1996).

Two underlying mechanisms have been identified by scholars as an explanation for this failure:

Resource allocation processes:

Christensen (Christensen and Bower, 1996) argues that established firms fail to allocate resources to disruptive innovations because they do not address their current customer base. He bases this argument on resource dependence theory by Pfeffer and Salancik (1978), where Christensen posits that firms are governed by their resources and the sources of their resources, namely their existing and most profitable customers.

Christensen elaborates this view with his resource, process, and value [RPV] theory (Christensen and Overdorf, 2000). Christensen argues that an incumbent's values and processes tend to favor sustaining innovations and this is where they invest their resources, because disruptive innovations have inherent qualities, stated above, that make them unattractive to incumbents.

Inadequate market-facing organizational competency:

Henderson added to the disruptive innovation theory by suggesting that another reason for companies to be unable to develop disruptive innovations is the lack of marketing competency (Henderson, 2006). Exploring new, disruptive markets requires a major change in patterns of behavior and search (Danneels, 2002). The lack of this competence in companies focused on their current customers, hinders companies from indentifying emerging customer trends peripheral to their current business (Henderson, 2006).

Christensen and other authors (Christensen, 2006; Christiansen, 2006; Danneels, 2004) have pointed out examples of established players that have successfully developed disruptive innovations. In Christensen's research on the disk drive industry, he shows that incumbents who maintained their dominance through the disruptive change, did so by spinning off the sub-unit developing the 5.25-inch drive (Christensen and Bower, 1996). Thus, Christensen's

recommendation for established players is to set up autonomous units or spin-offs to incubate disruptive innovations (Christensen and Bower, 1996; Christiansen and Raynor, 2003). In contrast to this recommendation, other scholars promote organizational structures that are loosely coupled with each other and enable organizations to simultaneously host evolutionary and revolutionary innovations from within (Tushman and O'Reilly, 1996). Thus, questions remain on what makes some incumbents successful while others fail and whether companies always need to spin-off their disruptive projects (Danneels, 2004). Although a spin off can successfully protect projects, it also isolates it from crucial company resources and capabilities and the ability for the company to learn (McDermott and O'Connor, 2002). This is why authors O'Reilly and Tushman (2008, pg. 202) posit that "ambidexterity is one solution to the innovator's dilemma". The concept of ambidexterity will be explained in detail in the next section.

2.2 Organizational Ambidexterity

Organization ambidexterity [OA] is an organizations' ability to successfully explore and exploit simultaneously. Researchers have diversely defined OA and its importance has been noted across different fields of management research, including strategic management, innovation management, organization learning and organizational behavior (Simsek, 2009). We operationalize ambidexterity as the ability of organization's to simultaneously host different innovation streams (Tushman, et al., 2010), specifically in our case sustaining and disruptive innovations (Danneels, 2006; Simsek, 2009).

Research points to two forms of ambidexterity, structural ambidexterity, which is achieved by creating separate structures for the different kinds of activities and contextual ambidexterity, which resides in an individual's ability to allocate time between exploration and exploitation (Raisch, et al., 2009). As this work concerns mechanisms at an organizational level, we will focus on structural ambidexterity. The main proponents of this school are O'Reilly and Tushman (O'Reilly and Tushman, 2004; Tushman, et al., 2010; Tushman and O'Reilly, 1996). Structural ambidexterity is achieved through distinct units within the organization held together by a common strategic intent, an overarching set of values, and a leadership team that can manage differentiated sub-units with clearly defined interfaces that leverage existing assets (O'Reilly and Tushman, 2008). Research shows two key components are necessary for achieving structural ambidexterity. First, structural differentiation of the different activities in distinct units ensures that exploratory units enjoy required freedom and flexibility, while exploitative units can carry on with their ongoing business (Jansen, et al., 2008). However, to reduce the risk of isolation, targeted integration mechanisms between these units are

necessary (Sirmon, et al., 2007). Second, the role of the top management is crucial for managing the contradictions arising from managing innovation stream (Smith and Tushman, 2005).

While several works have confirmed the business performance enhancement through ambidexterity (Gibson and Birkinshaw, 2004; He and Wong, 2004), there remains a gap in understanding of the mechanisms by which organizations achieve ambidexterity, as Gupta et al. (2006, pg. 697) noted, “although near consensus exists on the need for balance, there is considerably less clarity on how this balance can be achieved”.

Few works have empirically studied organization designs required to deal with multiple innovation streams, with the exception of (O'Reilly and Tushman, 2004; Tushman, et al., 2010). The results from analyzing innovation episodes within 13 business units was the nature of ambidextrous organizational design- high structural differentiation of exploitative and exploratory units with targeting structural linkage (Tushman, et al., 2010). In studying the cases of USA Today and Ciba vision, the authors O'Reilly and Tushman (2004) also identified the need for an overarching vision that permits the otherwise contradictory units to coexist. However, these case studies explore incremental vs. architectural innovations (Henderson and Clark, 1990) or discontinuous innovations, which involve fundamental competence destroying technological changes (Tushman and Anderson, 1986) and do not deal with disruptive innovations. As shown in section 2.1.2, disruptive innovations have certain inherently unfavorable characteristics specific to them. Thus empirically exploring the role of ambidexterity in hosting disruptive innovations is still an open field (Danneels, 2004).

3 Research Question and Methodology

3.1 Research Question

This research brings together three fields in management research, namely BOP research, disruptive innovation theory and organizational ambidexterity. Analysis of strategy for MNCs in low-income markets is an emerging field of international strategy research (Ricart, et al., 2004). Some of the most important aspects of products developed for BOP markets is the need for extreme affordability and adaptation to local needs (London and Hart, 2004; Prahalad, 2004; Tiwari and Herstatt, 2012). By developing disruptive innovations to seize the opportunities of the BOP, companies could potentially “give themselves a chance for sustained corporate growth while also helping to lift the poor out of poverty” (Hart and Christensen, 2002, pg. 56).

However, questions regarding how large companies can successfully develop disruptive innovations from within their boundaries remain (Danneels, 2004). Authors O'Reilly and Tushman posit that "ambidexterity is one solution to innovator's dilemma" (O'Reilly and Tushman, 2008, pg. 202), however fail to answer the 'how'.

This research will try to answer this question by analyzing the case of GE Healthcare and its innovations for the Indian mass market. GE Healthcare is one of the few MNCs committed to developing products for low-income markets and has been developing several products over the last few years (Immelt and Govindrajana, 2009).

Thus the key research question is:

What organizational structures and processes would enable incumbent firms to systematically create disruptive innovations for the BOP markets?

3.2 Methodology

Exploratory case study methodology has been chosen for this research. Exploratory case study method is considered apt when insufficient theory exists in the area and a deep understanding into the "how and why" is required (Yin, 1994). Single case study research can richly describe the existence of a phenomenon (Siggelkow, 2007) and extend and refine theory (Eisenhardt, 1989).

Secondary data, including company press releases, annual reports, and primary data in the form of interviews as well as internal company documentation have been analyzed. In total 11 interviews were conducted with senior management at GE Healthcare India involved in low-cost innovations, including senior executives. The interviews lasted between 30 and 60 minutes and were semi-structured. Most interviews were conducted in person and some follow-up interviews were conducted over the telephone. All interviews were recorded and transcribed. Notes of the meeting and impressions, over and above the interviews were written the same day, conforming with the "24-hour rule" (Yin, 1994).

Once transcribed, the interviews and secondary data were coded using content analysis principles with the software MAXQDA. This enabled us to code key passages, add memos to codes and sort codes. We continuously sought to sort and match codes with theory. This iterative comparison between emergent theory and case study data led to additional memos and new insights. At the end of the transcription and content analysis process, memos and codes were categorized into conceptual clusters, e.g. challenges in commercialization or enablers of low-cost innovations.

4 Empirical data

4.1 GE Healthcare Case Study

4.1.1 About GE Healthcare

GE Healthcare is a division of the American conglomerate, General Electric. GE Healthcare had revenues of 18.3 bn USD in 2012 with about 48000 employees worldwide¹. GE Healthcare's main revenue streams are medical equipment and services in medical imaging, diagnostics, IT and patient monitoring systems².

4.1.2 Early successes in frugal innovations

GE established the Jack F. Welch Technology Center [JFWTC] in Bangalore in 2000 to capitalize on the R&D talent available in the country (GE, 2010b). It is GE's largest R&D center and the first one to be built outside the USA. Healthcare is one of the focus areas of the R&D center and was established as a center of software excellence. The engineering teams at the JFWTC, working together with GE's global teams, were solely focused on developing GE's premium products.

Around 2001, a lead engineer in GE's cardiology team wondered why none of GE's products, like the ECG device that his team was working on was not available in Indian clinics, beyond the high-end hospitals in India's tier 1 cities. The glaring answer was the high price tag of GE's premium products. It was apparent that GE would not be able to penetrate these emerging markets with its premium products and would need to develop products especially for these markets. Even the Indian sales teams were demanding low-cost products.

The team in India tried to push the idea for a low-cost ECG device for India and India-like markets, but only after 3 years did they receive a positive response. A leader at the global level bought into the idea and allocated an engineering team in Bangalore to develop a low-cost ECG device. He also brought in technology experts from Germany to help the Indian team with knowledge transfer. The answer was the MAC 400, which was priced at about 1000 USD, compared to premium segment ECGs that cost about ten times as much.

The value proposition of the MAC 400 was not only the cost advantage but also portability and robustness to work in an environment with power fluctuations and dust. Portability was an important feature as doctors in India, especially in tier 3 cities and rural areas have multiple practices and travel to smaller clinics in more remote regions. The cost advantage was achieved by creating a smaller device that retained only key functionalities. Standard and commercially available subsystems were chosen, e.g. a standard, off-the-shelf charging

¹ GE.com website investor relations

² www.gehealthcare.com

system used for mobile phones was used instead of a custom-made power supply system and more commonly used printer systems were chosen, like those used for bus ticketing systems. The next version, the MACi [I stands for India], with a price tag of 535 USD, was launched in 2009. This had an even more cost optimized design than the MAC 400, e.. reduced printer size. Despite being such frugal products, the MAC 400 and MACi run the Marquette 12SL analysis program that runs on all high-end ECG devices. This way the clinical efficacy of the device is not compromised on. As noted by the GE senior executive responsible for the MACi and MAC 400 development:

“One of the fundamental things is that value product does not mean old technology. But many companies do this. They would sell the last generation products cheaper in emerging markets. That is nonsense. In our case, the value product means high-tech engineering but cost optimized”

The MAC 400 and MACi were considered breakthrough at GE. It was not only breakthrough because GE had managed to develop such a low-cost ECG device, but it was also breakthrough in terms of the value network GE created to sell these products. GE’s portfolio until then only had expensive 10000+ USD and its sales, servicing teams were built for such a high-end product portfolio.

4.1.3 Raising the Stature of Everything Global

These initial successes in product development led to major shifts within GE by 2009. In the letter to the shareholders, as part of the 2009 annual report, GE’s Chairman announced a push for reverse innovation (as explained in section 3.1) to capture new opportunities by “taking the low-cost healthcare devices designed in India and China and marketed in the developed world”. GE also announced the Healthymagination initiative in May 2009, with the commitment to invest 6 bn USD in the next 6 years to develop products with a goal “to provide better health for more people at lower cost” (GE, 2010a). The Healthymagination initiative was a key component in the GE’s 2009 Renewal Model with a focus on “creating market solutions for societal problems”.

In late 2009, GE also decided to give India its own Profit and Loss [P&L] responsibility. Traditionally, GE’s regional business leaders reported to their respective GE product business leaders. Under the new structure, the business unit leaders reported to John Flannery, the then CEO of GE India, who would in turn report to GE’s Vice Chairman. This was done to ensure India had the empowerment to develop products for its own markets. Jeff Immelt, Chairman of GE in the official press statement (Mahajan-Bansal and Goya, 2009) described it as:

“With an integrated team, we can develop products and services designed specifically to meet local needs and, potentially, for export to other markets”

This was the first time a country, other than the USA had its own P&L. This also meant it was in charge of its own growth strategy and its own budgeting processes. Following this, GE China also got a similar status.

In 2010, GE established the Global Growth Organization to oversee operations in high-growth markets. Thus GE continued to push its emerging markets strategy by “raising the stature of everything global in GE” (Lemer and Crooks, 2010).

4.1.4 Pushing further down the Pyramid

In India, a new range of products in infant-care was launched under the brand of Lullaby. The Lullaby warmer was launched first in 2009 at a price tag of 3000 USD about 60-70% lower than premium segment warmers. Next in the range, the Lullaby LED Phototherapy [LED PT] Device, developed in India for India-like markets was launched in 2011. The LED PT’s value proposition of low Total Cost of Ownership [TCO], energy savings, ease of use and serviceability, made it a runaway success not only in India but also outside India.

Even with the new range of Lullaby infant care products, the Maternal and Infant Care [MIC] team in India realized that the 3000 USD warmer could sell in top-end clinics in the metros, but could not impact the broader issue of infant mortality rates [IMR] of the country. They realized that with their product line they were serving countries like USA and Western Europe or even the top-end of the developing world that did not have a problem of IMR. The real issue of infant mortality was in poor regions of Asia and Africa. In their current markets, the aim of infant care was saving premature babies born too early, e.g. at 24 weeks whereas in countries like India, the issue was solving even more basic problems of survival. As the MIC Marketing executive put it:

“In the current state of the portfolio, we had some fantastic incubators and warmers, which are best in class.... but the products are made for those markets where the core issue of IMR is under control, whereas in countries like India, IMR is very high. We needed something, which is at a price point that can make an impact to the IMR”

The MIC India team is currently working on a range of products that caters to segments in Tier-2 and Tier-3 cities and villages, mostly local clinics and government hospitals. These hospitals, MIC India’s research showed, currently have low quality local warmers that are often broken or overused or use 200-watt bulbs to keep babies warm. The MIC team aims to sell its new range of cost-effective products to these segments and push towards selling to clinics that have not adopted any warmers yet.

To cater to segments further down the pyramid, i.e., home births that occur outside a hospital or clinic that represent about 51% of births in rural India (Chandramouli, 2011), the MIC India team has partnered with Embrace. Embrace is a non-profit organization that has developed an innovative, low-cost baby warmer priced at 250 USD that looks like a sleeping bag for a baby. This is portable and does not require a continuous supply of electricity. The MIC team is now working on an end-to-end solution that not only includes products at significantly lower price points but also a go-to-market strategy that includes collaborations with the government and NGOs. This new approach is highlighted in this quote from the MIC Marketing executive:

“We have dropped our – what should I say, reluctance - and we are more than willing to form partnerships with Embrace and to work with East Meets West to address the BOP market. So these are the different efforts of establishing a performance [value] segment. And my role is to facilitate the creation of low-cost value products in all these different ways...so it is a very concerted strategy”

GE Healthcare is partnering with East Meets West [EMW], an international development agency focused on neonatal health, to distribute and service GE Healthcare’s infant care products in developing and rural regions. While GE provides its products, servicing and technical expertise, EMW provides monitoring and training for the medical personnel. The MIC Team in India is also starting a concerted effort to work with government as they realize that only through such partnerships can they have an impact on the IMR.

4.2 Characteristics of the Value Segment Products

The value proposition of the value segment products at GE Healthcare go beyond cost-effectiveness. Products developed for the BOP and in general for emerging markets need to be well adapted to local needs (London and Hart, 2004). GE Healthcare’s value products fit this mantra, as supported by this quote by the CTO of the GE Healthcare India talking about the considerations behind the MACi:

“[In places where the MACi was to be deployed], there was no technician who knew where the leads had to be attached to get a reliable ECG so ease-of-use became an important criterion, as important as cost. Most of our devices sit in air conditioned rooms like this, they are plugged into the wall with back-up power. Then you look at places [where MACi was to be deployed] that get three hours of power a week. So that became another consideration. If the patient cannot get to where the ECG machine is because it is 50- 100 kilometers away, the ECG machine has to get to the patient. So

something that can be carried around. While the first thing on the surface always seems to be cost, that is really not the whole story and sometimes not even half the story. In fact most of what is in the MACi has nothing in common with most of the ECG machines we have except for the algorithms and the software, which is kind of the legacy that we have and that we built over a period of time”

The other “half of the story” of GE Healthcare’s value segment products entails other product characteristics summarized in this section:

1. **Low complexity:** The value segment products are stripped of non-essential features and target satisfying critical user needs. The products would compromise on unused features or even on convenience in order to keep the complexity and hence the cost of the product low. In case of the MACi, the team decided to build a single-channel ECG without a display, which meant that it would be more inconvenient for doctors to read the ECG in comparison to 3-channel digital displays, but the information would be the same.
2. **Ease of Use:** In most cases, the technicians operating medical devices in Indian clinics are minimally trained, especially in more remote regions. To make sure they can properly operate the devices, ease of use is an important aspect in product development. The MACi is designed with a minimum number of buttons and its regular usage requires only the on/off button. Similarly the MIC team on one of its immersive market research field trips evidenced how a baby died because the nurse thought that the warmer was on when only its observation lamp was lit. This had a deep impact on the team and it decided to make its products “absolutely foolproof”. The engineering lead of the MIC team recalled this incident and said:

“See it is very easy for me to say at least this basic knowledge should be there with the nurse, or that we should train them... but now we say we need to make the product foolproof for untrained people too”

3. **Reliability and Serviceability:** Products sold to remote parts of India would be difficult to service because of poor infrastructure to reach there.. Keeping this in mind, GE’s products are also designed for serviceability by ensuring those parts that breakdown most often are done without or extra components are sold along with the product. In general the engineering teams try to minimize the number of parts, especially the number of movable parts.
4. **Environmental fit:** BOP products generally have to function amidst harsh conditions: high levels of dust and humidity, large fluctuations of voltage, etc. Besides this, hospitals are generally not equipped with high-quality infrastructure. An example is the lack of wall oxygen supply in most hospitals, which is recommended for resuscitation [breathing] equipment for premature babies. To counter this, GE Healthcare’s resuscitation device, currently under development in India, will work under either condition: one in case there is a wall oxygen supply available and in another case where

the equipment is connected to an external oxygen cylinder. The device is able to function even with power breakdowns and time lags. As an executive of the MIC segment put it:

“So this is the environment in which we work. Now, you cannot try to say, okay, get me reliable power and I’ll give you a product, that doesn’t work... then you’re not in the game and you’ll continue to create products that don’t work. So now when you have [these conditions], you need to come up with some other innovative way of doing things”

5. Local use cases: Doctors in India apply these medical equipment for different use cases. For instance, in India several hospitals and clinics conduct large scale screening camps, often for free, in rural areas or even urban areas to pull in customers. Thus the MAC i is designed in such a way that it can take 500 ECG’s in a single charge. Also its requirement for portability came up because doctors in India sometimes are required to travel between clinics.
6. Cost-effectiveness: The basic requirement of these products, “the right to play” is to make value segment products affordable for the market. This does not mean a 20% or 30% reduction in cost but more drastic, between 70% and 90% reduction. If one compares the MACi and premium ECG devices sold in developed markets, there is difference of a factor of 20 in price. Not just the initial investment but the Total Cost of Ownership must be kept low.
7. Clinical efficacy: In all GE Healthcare’s products, clinical efficacy is not compromised. All products go through rigorous certification processes just like premium segment products do. The MAC 400 and MACi run the same Marquette 12SL analysis program as the high-end ECG devices to interpret the ECG. This is the core of their technology, built on several years of testing and experience. Similarly, the MIC segments products all have high clinical efficacy but are geared towards saving late-stage premature babies vs. the premium segment incubators that are designed to save extremely premature babies.

In some cases, designing for one feature brings advantages in cost at the same time. For instance, in case of the LED PT, the team decided early on to do away with the cooling fan, which was a feature in previous generations of PT devices. This decision was taken in order to ensure reliability of the product as the fan system is very susceptible to breakdowns. Thus

the team designed the product with vents and natural airflow. This had the positive side effect of removing complexity and cost simultaneously.

These characteristics are very much in line with the characteristics of frugal innovations identified by authors Tiwari and Herstatt (2012). In addition to those points, clinical efficacy and product adaptation towards local use cases are additional characteristics that GE's frugal medical technology developed for India have.

4.3 How are value segment products potentially disruptive

As seen in the section above, GE Healthcare's value segment products trade-off features and convenience for price. With drastic price reductions, these products can be sold to new segments that were previously not using the product or using only a poor substitute. Value segment products have other features that make it attractive for mass markets in emerging economies, such as ruggedness, reliability and fit to the environment. Thus, besides price, the new performance attributes of these value segment are also in some cases, portability, reliability and ease of use.

There is also emerging evidence of better versions of some of the value segment products being sold in more mature markets, e.g. the MAC 800, a later version of the MAC 400 is selling in the USA and Western European markets in emergency situations like in an ambulance (Immelt and Govindrajan, 2009). Also a significant portion of Lullaby range warmers and LED PT device are selling in more developed markets. These warmers and PT devices could potentially enable hospitals to purchase multiple units rather than just a few units traditionally purchased only for the Neo-Natal Intensive Care Units.

While it is true that these low-cost devices open up new markets, e.g. in rural India, question does remain as to what extent these low-cost devices will disrupt existing markets. Disruption is a process and not an event (Christensen, 2006) and the evolution of the healthcare industry in developed markets and other factors will play a role in this disruption process.

5 Analysis

5.1 Overcoming innovator's dilemma

In section 2.1.2 the inherent qualities that make disruptive innovations unattractive for established firms were described, along with the underlying organization's mechanisms that prevent them from investing in disruptive innovations. This section will elaborate on how GE

Healthcare is countering these mechanisms with structures and routines that enable it to systematically invest and commercialize disruptive innovations.

5.1.1 Dedicated Processes

GE has created dedicated processes by putting new structures in place to allocate resources to disruptive projects. The main structure is the GE India P&L. Until 2009, GE Healthcare was organized along product groups, where each product group was responsible for its P&L. In late 2009, GE introduced its “one GE” strategy in India, where it gave GE India its own P&L. This also meant own control of budget processes. As John Flannery, the previous CEO of GE India put it in an interview to a newspaper:

The change to direct reporting is monumental as it fundamentally changes in many ways the business operations...The decision making is faster and so is spotting opportunities and acting upon them. India for a lot of MNCs is 3-5% of business, but for myself and the team here it's 150% of our business. So, the sense of urgency is very different in that context (Times, 2010)

GE India has control of budget and product development for the local market. Thus if opportunities for the BOP are identified, those projects get funded from GE India directly, rather than having to apply for funding at the headquarters.

GE India reports into the Global Growth Organization [GGO], headed by John Flannery, the Vice-Chairman of GE. The GGO was setup to empower the emerging markets with resources and give it more autonomy to make decisions. The GGO is responsible for funding “In Country for Country” [ICFC] programs. This stands for products designed and developed in a country for that country. The program manager for ICFC programs in India summarized the advantages of these structures appropriately:

“What that gives you is the ability to seek funding for opportunities that are highly relevant in the Indian marketplace. So you go to John and tell him, “Here’s this market opportunity”. If I look at the overall number, it may not get prioritized within the Healthcare business because it’s still a small number. It’s an infant market. We need to create this market, grow this market. Whereas for India, it’s all the more relevant because [GE’s operations in] India can grow only if we invest the kind of money that we need for such products that are extremely relevant and designed solely for Indian requirements”

GE Healthcare India has setup a unique role of a program manager for ICFC programs who pivots between GE Healthcare India and the GGO. He is responsible for ensuring ICFC project ideas from India get appropriate access to funding from the GGO. In a broad sense he

is the ambassador for frugal innovations from India to the GGO or GE's Headquarters. He described his role as:

“On one hand I work with healthcare folks [in India] to determine what the market needs are, what the commercial pain points are, what the product portfolio gaps are. I then go back to GGO and explain to them why these are the gaps, [and] why we need the money to fill these gaps”

Thus GE Healthcare India has put one person in charge of the process, who ensures the disruptive projects for the Indian market get the resources they need.

5.1.2 Reconfigured Values

The Healthymagination initiative has brought the need to improve access and affordability of healthcare to the forefront. To quote Immelt, the Chairman of GE in the letter to their investors:

This commitment has transformed our entire approach to health— from the way we motivate and engage employees and consumers, to the way we collaborate with partners and develop new products. Today, healthymagination serves as a rallying cry for meaningful innovation to address the world's biggest health issues. It's a call for better products at more price points in more regions... In short, it's a call for better health worldwide. (GE, 2011)

GE has been able to operationalize the Healthymagination vision by changing its innovation process. Cost, access and quality are now the evaluation criteria in the companies' New Product Introduction [NPI] process. The value propositions of new product introductions are evaluated against the three axes of cost, quality and access. As the erstwhile CEO of GE Healthcare Systems, Omar Ishrak noted about the Healthymagination initiative³:

“All new products must be designed in a way that a value proposition for those products must be considered during the initial phase of design..and by value proposition, we mean that whether that product is going to provide an improvement in cost to the health care system, ... whether it will increase access, ...or whether it will improve quality. So every new product will have to be gauged and assessed as to what value it will provide in terms of cost, quality, and access”

³ Online Interview http://www.ge.com/audio_video/ge/health/healthymagination_vision.html

5.1.3 Dedicated Resources

GE's Healthymagination initiative has also set aside 3 bn USD out of the total 6 bn USD commitment to launch products that improve cost, access and quality of healthcare. This involves not just in-house development but also acquisition or partnerships with external companies. Thus the Healthymagination initiative also provides dedicated funds for disruptive innovation ideas that might come from within or outside the firm. Projects like the cooperation with Embrace fall into this category. The Healthymagination initiative is also monitored via a neutral third party, the Oxford Analytica to track how its initiatives deliver on its commitments.

Moreover, GE India and GGO, with their mandate to increase GE's presence in emerging markets, have dedicated budget for developing products for the local markets.

By dedicating resources, processes and reconfiguring values to accommodate disruptive innovations within its organizational structures, GE Healthcare is combating the tendency of resource allocation processes within established companies to ignore disruptive innovations as explained in 2.1.2.

GE has also taken proactive steps to counteract the lack of market-facing organizational competency, Henderson's explanation to incumbent failure (Henderson, 2006). This is elaborated in the next section.

5.1.4 Building capability

GE has built local capabilities for product development within the value segments. Besides the engineering capability that it already had in place through the R&D center, GE Healthcare has created teams with product management, upstream marketing and market research skills in key emerging markets such as India for certain business areas. For instance, in the MIC space, there are product managers in India, China, Latin America and Middle East. The MIC space in India has a complete marketing and product development team involved in all aspects from market research, development as well as managing local partnerships and government engagement. The importance of this was emphasized by the MIC value segment leader:

“So this is one of the most important things- setting up the organizations such that the team has the empowerment to do things, the team has experienced people to do it, and the team has the right people sitting here to actually identify what exactly the need [of the local market] is. So you need qualified people who have different skill sets. You can't just run this whole thing with an R&D/engineering mindset”

5.2 Combating the unfavorable characteristics disruptive innovations

This section describes the approaches GE Healthcare India has taken to overcoming the innovator's dilemma, structured along the unfavorable characteristics of disruptive innovations as described in section 2.1.2.

Financial unattractiveness: There is a large chasm between developed markets and BOP markets, especially in terms of informal economies (Banerjee and Duflo, 2007), and institutional voids (Khanna and Palepu, 1999). These new environments pose new risks to MNCs and are thus sometimes viewed financially unattractive to companies, just like in the case of disruptive innovations. Even at GE before 2009, proposals for these low-cost innovations were often met with fear of cannibalization and dragging down profit margins (Immelt and Govindrajana, 2009).

In terms of internal product development processes, GE Healthcare India is substantially diverging from the norm by building some of the lowest cost equipment within GE Healthcare, in some cases about 80-90% cheaper than the high-end products in their portfolio. In order to manage risks involved in the development and commercialization process, GE Healthcare has begun to assess many of these market risks and technical risks upfront. This approach is summarized well by this quote by the MIC value segment leader:

“So what we are trying to do is, try to move risks up to the front of the program, do things as early as possible...Can we find out the customer needs before even we embark on a New Product Introduction [NPI], which means can we fund a small team to go and identify needs even though it's not part of any NPI process, so that once a need is identified then we can put it to the NPI process very quickly. Can we mitigate technology risks earlier in the process as a separate activity, not as part of the NPI process itself. ... So, for example, can we get a heater head at 20% of the cost of the current heater head? ...So all of those [go to market] strategies have to be thoroughly thought of. So the entire supply chain piece, the entire commercialization piece, the service piece... all this has to form the go/no go for the product development”

GE Healthcare exploits these innovations by selling them in less price-sensitive markets around the world at a higher price. Many of GE's ICFC are being sold outside India, for instance in Eastern Europe, Middle East and Latin America. The MIC value segment leader explains the success of selling its products outside India:

“If you can succeed with decent margins in an extremely price sensitive market like India then when you go outside India you can potentially extract more value and get a better margin profit”

This is one of the basic tenants of reverse innovation, taking innovations first adopted by emerging markets to more mature markets (Govindarajan and Ramamurti, 2011). GE Healthcare with its disruptive innovations wins by keeping the cost low and exploiting higher margins when selling these products in more mature markets.

Incompatible value networks: As explained in section 2.1.2, disruptive innovations do not fit into the embedded value networks of the organization and new market disruptive innovations typically create new value networks (Christensen and Raynor, 2003). GE Healthcare faced- and is still facing- similar challenges of embedding their low-cost innovations into their existing value network. This quote from the MIC Marketing executive summarized the problem well:

“Today we sell premium products to premium hospitals. ... Now once you decide to go to the bottom of the pyramid, once you decide to serve primary healthcare it’s a completely different ball game. So it means you’re going to the rural areas, you’re going to mom and pop sort of entrepreneurs...”

Or this quote by the GE executive responsible for the MAC 400 and MACi:

“We thought we could use our distributors. But when we asked them they said ‘No, I can’t send my guy to the villages for the small margin of 80 USD. I have my rep in Mumbai and I have him sell big equipment. That gives me much more money’. They refused to do that [sell the low-cost ECG devices]”

Besides the distribution channel, GE Healthcare had to learn to work with different types of customers, including the Government in different countries because they mainly procure equipment for primary health centers in remote parts of countries.

This required GE Healthcare to find a more holistic approach to serving the BOP markets. The MIC value team has defined its vision as “making an impact on Infant Mortality Rate”. This vision, rather than a one-dimensional mandate to create products for the BOP, makes them take a more holistic approach. This affects their go-to-market strategy, e.g. partnering with NGOs such as East meets West to provide a more comprehensive support to providers and also how they develop their products, e.g. by making sure their products really fit the unique needs of the BOP.

GE Healthcare is also innovating on other business process fronts, e.g. providing financing to purchase equipment by tying up with local banks to ensure doctors in rural areas, who are generally managers/entrepreneurs of their practice, have access to loans. They are learning from, and partnering with distribution channels of other industries like pharmaceutical industry and consumer goods like blood pressure monitors to build a distribution network for their low-cost products.

5.3 Ambidexterity in action at GE Healthcare

These innovations represent emerging market opportunities, where companies need to diverge from the ongoing business and invest into exploration. As literature points out, it is important for companies to balance exploitation and exploration, i.e. to be ambidextrous. This section describes how GE Healthcare achieves ambidexterity and how it hosts sustaining and disruptive innovation streams within its boundaries.

5.3.1 Structural differentiation and integration:

GE Healthcare has adopted an ambidextrous design to balance its exploitation and exploration activities (O'Reilly and Tushman, 2004). The existing high-end product segments serving developed markets are organized under the “premium segment” whereas the emerging-market products developed to make technology affordable are organized under the “value segment”.

The premium segment caters to product development for GE Healthcare’s existing high-margin customers, which represents sustaining innovations. The value-segment caters to product development for low-income markets, representing disruptive innovations.

These two segments are managed by the manager of that product segment within GE Healthcare. The value segment leader is typically based in an emerging market, e.g. India, China. The main task of the value segment leader is to develop and market value products in emerging markets and globally. The segment leader has functions related to product development reporting to him, e.g. marketing, engineering. Local sales teams who sell the products are organized regionally.

This organizational design ensures that the value segment leader is empowered to develop products for BOP markets. The CTO of GE Healthcare described this empowerment:

“Each of these businesses today inside of the company has a general manager for value and that person, even though their business might be one-twentieth of the premium business, they [the value segment general manager and the premium segment general manager] are peers and at the same level of the staff”

While structural differentiation is necessary to clearly delineate exploration from exploitation, organizations run the risk of isolating explorative activities and under-utilizing existing assets. Thus structural differentiation needs to be combined with targeted integration activities (Jansen, et al., 2008; O'Reilly and Tushman, 2008). With the ambidextrous design, GE Healthcare ensures integration through the ambidextrous manager who is responsible for both segments (Tushman, et al., 2010). The premium segment and the value segment also share a common CTO and key product development decisions go through him. These managers need to ensure that newly created value segments can leverage the knowledge and expertise that exists within the company. As the MIC engineering leader described the integration:

“It’s extremely important that you don’t lose the global connect. ..You have to leverage the existing platform; otherwise it’s completely inefficient...So, for example, the heating system [in the baby warmer], we do leverage a premium platform for our heating because that is very crucial [part] and we have 30 years of experience in heating... Of course, we have reduced cost, we have changed the material, [etc]”

As seen in the figure below, the organizational design of GE Healthcare is very similar to the ambidextrous organization described by O’Reilly and Tushman (2004). The crucial difference here is that all functions related to product development fall under these segments whereas sales is a regional function and does not fall under this matrix.

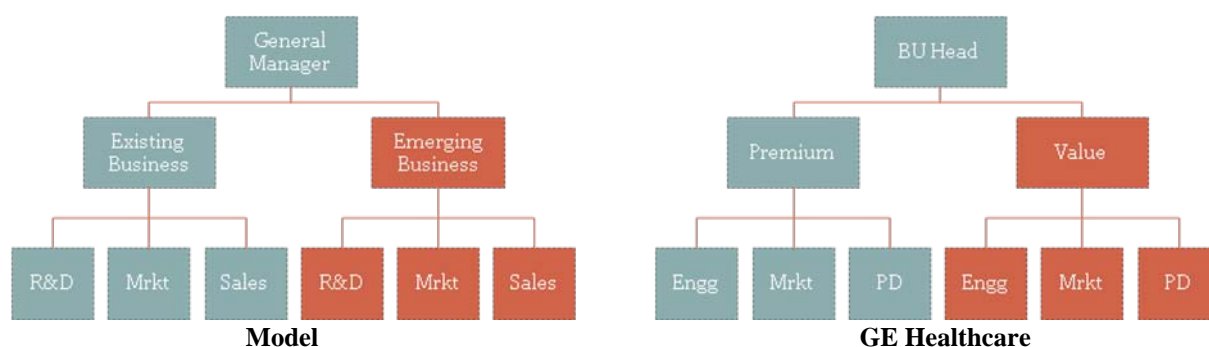


Figure 1: Comparison of Ambidextrous Organizational Design by O’Reilly and Tushman (2004) and GE Healthcare’s Organizational Design.

Not only is there empowerment through product-based segmentation, i.e. premium and value segments, but also through regional segmentation.

As shown above, GE Healthcare achieves structural ambidexterity by putting in place a differentiated structure with integrative mechanisms, as well as dedicated resources with necessary competencies and dedicated processes to ensure disruptive innovations streams can simultaneously be hosted along with existing sustaining innovation streams.

5.3.2 Overarching vision:

Research points out the need for strategic intent to pursue exploratory units as well as an overarching vision across the exploration and exploitation units (O'Reilly and Tushman, 2011). GE's strategic intent of being a global organization legitimizes the need to create strong local capabilities in emerging markets. At the same time, the Healthymagination initiative provides a common vision for across GE Healthcare. Healthymagination is a commitment by GE Healthcare made over a six-year period "to reduce costs, improve quality and expand access of healthcare for millions of people" (GE, 2009).

These three Healthymagination pillars have resulted in a reconfiguration of values within the company. GE Healthcare has traditionally been a technology leader in its industry, selling the most advanced equipment. Improving the quality of healthcare is what GE Healthcare historically has been innovating towards. With the goals of improving access and decreasing cost, the initiative explicitly aims at shifting GE Healthcare's focus towards low-income emerging markets. The Healthymagination initiative is thus able to create an overarching vision for units serving existing developed markets as well as new emerging markets within GE Healthcare.

6 Conclusion

Companies are increasingly looking at creating new markets for their products in low-income markets in emerging economies (Prahalad and Hart, 2002). However, serving these markets pose new challenges to MNCs from developing affordable, "good enough" products to commercializing these innovations. This article explores GE Healthcare's ventures into serving low-income markets in India with disruptive innovations. In particular, we explore organizational conditions that have enabled this incumbent to successfully and systematically develop and commercialize potentially disruptive innovations to serve BOP markets.

We see that GE Healthcare's ambidextrous structure creates the right conditions for it to host disruptive and sustaining innovation streams within its boundaries. The structural separation of premium and value segments as well as the overarching Healthymagination vision of improving quality as well as cost and access to healthcare gives value segment products legitimacy within the organization. Thus the two elements of ambidexterity of differentiated and integrated structures as well as an overarching vision have been shown to be helpful. In addition, as shown in this case, it is necessary to create measures to protect disruptive innovations within the boundaries of the organization, namely by creating dedicated processes and resources for disruptive innovations, reconfiguring values to help prioritize disruptive

innovations and building capabilities for exploring these new markets. The Healthymagination initiative has reconfigured the values of GE Healthcare, right down to what products GE Healthcare brings to the market. GE has also ensured dedicated resources, processes and capabilities for enabling disruptive innovations, through the Healthymagination commitment, GGO and GE India P&L.

GE Healthcare's changes in its organizational design have laid the foundations to help it systematically create potentially disruptive innovations. GE Healthcare has adopted a permanent ambidextrous design by separating all its product units into premium and value segments. This fixed structure is part of GE Healthcare's organization, as opposed to transitional organizational structures put in place for temporary innovation episodes (Tushman, et al., 2010).

Thus, this work contributes to emerging disruptive innovation theory, by exploring organizational designs required by incumbent firms to deal with strategic challenges associated with disruptive innovations in the context of BOP markets. It also contributes to organizational ambidexterity theory by providing substantial empirical evidence from the GE Healthcare case to show how a company has adopted an ambidextrous design to deal with hosting contradictory innovation types.

Companies like GE Healthcare are leading the way to create disruptive innovations in medical technology focused on the BOP markets. These disruptive innovations have the potential to not only make quality healthcare accessible to those who previously could not afford it, but also have the potential to be a solution to the global health care crisis

7 Bibliography

- Anderson, J. and Billou, N., (2007). 'Serving the World's Poor: Innovation at the Base of the Economic Pyramid'. *Journal of Business Strategy*, Vol. 28 (No. 2):14-21.
- Banerjee, A.V. and Duflo, E., (2007). 'The Economic Lives of the Poor'. *Journal of Economic Perspectives*, Volume 21 (Number 1):141-167.
- Chandramouli, K., (2011). 'Family Welfare Statistics in India'. Ministry of Health and Family Affairs.
- Christensen, C., Craig, T. and Hart, S., (2001). 'The Great Disruption'. *Foreign Affairs*, March/April:80-95.
- Christensen, C., Grossmann, J.H. and Hwang, H., (2008). *The Innovator's Prescription: A Disruptive Solution for Health Care*.
- Christensen, C. and Overdorf, M., (2000). 'Meeting the Challenge of Disruptive Change'. *Harvard Business Review* (March-April).
- Christensen, C.M., (1997). *The innovator's dilemma: when new technologies cause great firms to fail*: Harvard Business School Press.
- Christensen, C.M., (2006). 'The Ongoing Process of Building a Theory of Disruption '. *Journal of Product Innovation Management*, 23 (1):39-55.
- Christensen, C.M., Bohmer, R. and Kenagy, J., (2000). 'Will disruptive innovations cure health care?' *Harvard Business Review*, 78 (5):102-112.
- Christensen, C.M. and Bower, J.L., (1996). 'Customer Power, Strategic Investment, and the failure of leading firms'. *Strategic Management Journal*, 17 (3):197-218.
- Christensen, C.M. and Raynor, M., (2003). *The innovator's solution : creating and sustaining successful growth*: Harvard Business Press.
- Christensen, C.M. and Rosenbloom, R.S., (1995). 'Explaining the attacker's advantage: Technological paradigms, organizational dynamics, and the value network'. *Research Policy*, 24 (2):233-257.
- Christiansen, C.M., (2006). 'The Ongoing Process of Building a Theory of Disruption '. *Journal of Product Innovation Management*, 23 (1):39-55.
- Christiansen, C.M. and Raynor, M., (2003). *The innovator's solution : creating and sustaining successful growth*: Harvard Business Press.
- Collier, P., (2007). *Bottom billion*: Wiley Online Library.
- Danneels, E., (2002). 'The dynamics of product innovation and firm competences'. *Strategic Management Journal*, 23 (12):1095-1121.

- Danneels, E., (2004). 'Disruptive Technology Reconsidered: A Critique and Research Agenda'. *Journal of Product Innovation Management*, 21:246–258.
- Danneels, E., (2006). 'Dialogue on the Effects of Disruptive Technology on Firms and Industries'. *Journal of Product Innovation Management*, 23 (1):2-4.
- Eisenhardt, K.M., (1989). 'Building theories from case-study approach'. *Academy of Management Review*, 14 (532-550).
- Foster, R.N., (1986). *The attacker's advantage*: Summit Books.
- GE, (2009). 'Michael Barber Named Vice President, healthymagination'. *GE News Center*.
- GE, (2010a). 'GE Healthymagination Annual Report 2009'.
- GE, (2010b). 'GE's Technology Center celebrates Ten Years of Innovation in India'. GE News Center.
- GE, (2011). 'GE Healthymagination Annual Report 2010'.
- Gibson, C.B. and Birkinshaw, J., (2004). 'The antecedents, consequences and mediating role of organizational ambidexterity'. *Academy of Management Journal*, 47 (209-226).
- Govindarajan, V. and Kopalle, P.K., (2006). 'The Usefulness of Measuring Disruptiveness of Innovations Ex Post in Making Ex Ante Prediction'. *Journal of Product Innovation Management*, Volume 23 (Issue 1):12-18.
- Govindarajan, V. and Ramamurti, R., (2011). 'Reverse innovation, emerging markets, and global strategy'. *Global Strategy Journal*, 1 (3-4):191-205.
- Gupta, A.K., Smith, K.G. and Shalley, C.E., (2006). 'The interplay between exploration and exploitation'. *Academy of Management Journal*, 4:693-706.
- Halme, M., Lindeman, S. and Linna, P., (2012). 'Innovation for inclusive business: Intrapreneurial Bricolage in multinational corporations'. *Journal of Management Studies*, 49 (4):743-784.
- Hammond, A., (2010). *The Next 4 Billion: Market Size and Business Strategy at the Base of the Pyramid*: World Resource Institute.
- Hart, S., (2010). 'Taking the Green Leap to the Base of the Pyramid'. In: London, T. and Hart, S. (eds). *Next Generation Business Strategies for the Base of the Pyramid*. Upper Saddle River, New Jersey: Pearson Education, Inc.
- Hart, S. and Christensen, C., (2002). 'The Great Leap'. *MIT Sloan Management Review*, Fall 2002.
- He, Z.-L. and Wong, P.-K., (2004). 'Exploration vs. Exploitation: An Empirical Test of the Ambidexterity Hypothesis'. *Organization Science*, 15 (4):481-494.
- Henderson, R., (2006). 'The Innovator's Dilemma as a Problem of Organizational Competence'. *Journal of Product Innovation Management*, 23 (1):5-11.

Henderson, R.M. and Clark, K.B., (1990). 'Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms'. *Administrative Science Quarterly*, 35:9-30.

Howitt, P., Darzi, A., Yang, G.-Z., Ashrafian, H., Atun, R., Barlow, J., Blakemore, A., Bull, A.M.J., Car, J. and Conteh, L., (2012). 'Technologies for global health'. *The Lancet*, 380 (9840):507-535.

Immelt, J. and Govindrajnan, V., (2009). 'How GE is disrupting itself'. *Harvard Business Review*.

Jaiswal, A.K., (2008). 'The Fortune at the Bottom or the Middle of the Pyramid?' *Innovations: Technology, Governance, Globalization*, 3 (1):85-100.

Jansen, J.J.P., Tempelaar, M.P., Bosch, F.A.J.v.d. and Volberda, H.W., (2008). 'Structural Differentiation and Ambidexterity: The Mediating Role of Integration Mechanisms'.

Khanna, T. and Palepu, K., (1999). 'The right way to restructure conglomerates in emerging markets'. 77:125-135.

Lemer, J. and Crooks, E., (2010). 'Rice to lead GE in emerging markets'. *Financial Times*. New York.

London, T. and Hart, S., (2004). 'Reinventing strategies for emerging markets: Beyond the transnational model'. *Journal of International Business Studies*, 35 (5):350-370.

London, T. and Hart, S. (eds), (2010). *Next Generation Business Strategies for the Base of the Pyramid*. Upper Saddle River, New Jersey: Pearson Education, Inc.

Mahajan-Bansal, N. and Goya, M., (2009). 'Jeff Immelt: "India Will Be a Centrepiece in Our Growth"'. *Forbes India*.

McDermott, C.M. and OConnor, G.C., (2002). 'Managing radical innovation: an overview of emergent strategy issues'. *Journal of Product Innovation Management*, Volume 19, (Issue 6):424-438.

O'Reilly, C. and Tushman, M., (2004). 'The Ambidextrous Organization'. *Harvard Business Review*, 82 (4):74-81.

O'Reilly, C.A. and Tushman, M.L., (2008). 'Ambidexterity as a dynamic capability: Resolving the innovator's dilemma'. *Research in Organizational Behavior*, 28:185-206.

O'Reilly, C.A.I. and Tushman, M.L., (2011). 'Organizational Ambidexterity in Action: How Managers Explore and Exploit'. *CALIFORNIA MANAGEMENT REVIEW*, Vol. 53 (No. 4):5-22.

Olsen, M. and Boxenbaum, E., (2009). 'Bottom-of-the-Pyramid: Organizational barriers to implementation'. *CALIFORNIA MANAGEMENT REVIEW*, Vol. 51 (No. 4):100-125.

Pfeffer, J. and Salancik, G., (1978). *The external control of organizations: a resource dependence perspective*: New York: Harper & Row.

- Prahalad, C.K., (2004). *The Fortune at the Bottom of the Pyramid: Eradicating Poverty Through Profits*: {Wharton School Publishing}.
- Prahalad, C.K., (2011). 'Bottom of the Pyramid as a Source of Breakthrough Innovations'. 29 (1):6-12.
- Prahalad, C.K. and Hart, S., (2002). 'The Fortune at the Bottom of the Pyramid'. *strategy+business*, 1-24.
- Prahalad, C.K. and Lieberthal, K., (2003). 'The End of Corporate Imperialism'. *Harvard Business Review* (August):109-118.
- Prahalad, C.K. and Mashelkar, R., (2010). 'Innovation's Holy Grail'. *Harvard Business Review* (July-August 2010):132-142.
- Raisch, S., Birkinshaw, J., Probst, G. and Tushman, M.L., (2009). 'Organizational ambidexterity: Balancing exploitation and exploration for sustained performance'. *Organization Science*, 20 (4):685-695.
- Rangan, V.K. and Thulasiraj, R.D., (2007). 'Making Sight Affordable'. *innovations*, Fall 2007.
- Ricart, J.E., Enright, M.J., Ghemawat, P., Hart, S.L. and Khanna, T., (2004). 'New frontiers in international strategy'. *Journal of International Business Studies*, Volume 35 (Number 3):175-200.
- Siggelkow, N., (2007). 'Persuasion with case studies'. *Academy of Management Journal*, 50 (1):20-24.
- Simsek, Z., (2009). 'Organizational Ambidexterity: Towards a Multilevel Understanding'. *Journal of Management Studies*, 46 (4):597-624.
- Sirmon, D.G., Hitt, M.A. and Ireland, R.D., (2007). 'Managing firm resources in dynamic environments to create value: Looking inside the black box'. *Academy of Management Review*, 32 (1):273-292.
- Smith, W.K. and Tushman, M.L., (2005). 'Managing Strategic Contradictions: A Top Management Model for Managing Innovation Streams'. *Organization Science*, 16 (5):522-536.
- Tellis, G.J., (2006). 'Disruptive Technology or Visionary Leadership?' *Journal of Product Innovation Management*, 23:34-38.
- Times, T.E., (2010). 'We'll now produce what India wants: John Flannery, GE India'. *The Economic Times*.
- Tiwari, R. and Herstatt, C., (2012). 'Assessing India's lead market potential for cost-effective innovations'. *Journal of Indian Business Research*, Vol. 4 (Issue 2):97-115
- Tripsas, M. and Gavetti, G., (2000). 'Capabilities, cognition, and inertia: Evidence from digital imaging'. *Strategic Management Journal*, 21 (10-11):1147-1161.

Tushman, M., Smith, W.K., Wood, R.C., Westerman, G. and O'Reilly, C., (2010). 'Organizational designs and innovation streams'. *Industrial and Corporate Change*, 19 (5):1331-1366.

Tushman, M.L. and Anderson, P., (1986). 'Technological Discontinuities and Organizational Environments'. *Administrative Science Quarterly*, Vol. 31, No. 3.:439-465.

Tushman, M.L. and O'Reilly, C.A., (1996). 'Ambidextrous Organizations'. *CALIFORNIA MANAGEMENT REVIEW*, 38 (4):8-30.

Yin, R.K., (1994). *Case study research*. Thousand Oaks, California: Sage publications.

Appendix

Interviewees:

| Interviewee | Number of Interviews |
|---------------------------------------|----------------------|
| Program leader, MAC 400 and MACi | 2 |
| Mechanical engineer, MAC 400, MACi | 1 |
| Senior VP, Diagnostic Cardiology | 1 |
| CTO GE Healthcare India | 2 |
| Program Manager ICFC Programs | 2 |
| MIC Value Segment Leader | 1 |
| MIC Value Segment Marketing Executive | 1 |
| MIC Value Segment Engineering Lead | 1 |

i GE, Healthymagination, MAC, Marquette, Lullaby are all Trademarks of GE