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PROGRESS IN LEARNING AND INNOVATION

Jugaad

The Indian style of innovation

Report from research trip to India, October 2012

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Executive summary

Jugaad is an Indian phrase used to describe the kind of ingenuity that enables Indians to manage the large and small challenges of everyday life. The essence of Jugaad is to improvise, and to quickly and cheaply cobble a solution together from the materials you have at hand.

In recent years, Jugaad has gained attention among companies in the western world because products like Tata's Nano car and GE's MAC scanner for hospitals, have shown that the Indian approach to innovation can lead to solutions for the mass market at extremely low prices.

In October 2012, The Universe Foundation, as part of the project on "frugal" solutions, conducted a long research trip, with visits and discussions with a number of the leading Indian companies that deliberately aim to create low-cost solutions.

The main findings about the Indian methods can be read in this report.

Jugaad innovation springs directly from the very concrete restrictions that characterize everyday life in India: Average income pr. person in India is less than a tenth of the Danish average, and on a practical level, one must contend with an often miserable and unpredictable infrastructure, whether it's bad and congested roads or intermittent supplies of electricity and water.

Although one can find lots of fascinating and imaginative solutions to very specific and local problems in India, the aim of this report is to identify those parts of the Indian approach to innovation, which can be used to develop solutions that have commercial potential on a large scale.
The assumption has been that there are elements in the Indian methods and attitudes, which are so general, they can be transferred and used by Western companies as an inspiration and challenge to the usual way of thinking about business development.

The conclusion is that jugaad innovation certainly has relevance in the West - not least because there are many indications that the demand for products and solutions at much lower prices will increase. Financially strapped consumers in the Danish and western markets will demand basic solutions at a low price. Low prices will also be a prerequisite for Western companies in order to address the rapidly growing middle class in emerging markets.

Hard prioritization of features

Engineers and designers must have a proper understanding and feel for the end users' needs and ability to pay. Developers must prioritize extremely hard to remove all unnecessary functions, and in many cases designers must develop completely new ways to achieve a given functionality that are simpler and cheaper.

As one designer of medical devices at GE in Bangalore puts it: "Basically, I only use three buttons on the remote control for my TV. In the same way, we try to understand what the three most necessary buttons on the devices we develop are".

High volume

One strategy for low-cost solutions is to base the product on proven technology and to build it from components that are already produced in large numbers.

Generally, it is crucial to achieve a high volume. "We reach far more customers by lowering prices, but we earn less per customer", says a director of a hospital, which has organized its treatments inspired by Henry Ford and MacDonald's assembly line production. With higher volume and more customers the cost of development, equipment, personnel and buildings can be spread.

The courage to think differently

Perhaps the biggest challenge for Danish engineers is to accept that the price *must* to be radically lowered in order to reach the target group. Therefore designers must restrain their professional ambitions of advanced technology, smooth performance and optimum convenience for users.

Designers must, so to speak, develop from the bottom up, by starting to improve the solutions that the users in the lower part of the market currently have available - rather than trying to make lesser version of what the company is currently offering in the premium end of the market.

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Indhold

Indian innovation is a response to conditions in India

Anyone staying in India will inevitably spend a lot of time stuck in traffic. Traffic is chaotic, unpredictable, sometimes fast, sometimes slow, a jumble of different people and vehicles, and most of them do not necessarily follow the rules. Traffic is a battle to get ahead, but also a process, which requires collaboration and alignment. Otherwise, no one would get anywhere.
Jugaad, as the Indians call their approach to innovation, is a way to solve the problems of daily life, which arise directly from the Indian reality. Like navigating the traffic jam, one must be able to swerve and sway and "go with the flow".

In many ways, business in India resembles maneuvering through traffic. Companies are running an obstacle race between changing, unpredictable regulation and policies, and they must overcome an inadequate infrastructure, be it potholed and congested roads, or irregular water and electricity supply. All of this in a poor country where only a small percentage of the population has achieved a standard of living comparable with the West, while 600 to 700 million people only just got wind of life as consumers in the global middle class.

For the vast majority, India is characterized by constraints - and Jugaad is how you meet the challenge. Jugaad is a quick fix solution that exploits the opportunities and resources that are available here and now. Jugaad is improvisation. It doesn't have to be neat, it just has to get the job done - and it must be cheap.

Like the Chinese "Shanzhai" innovation, jugaad is not a method that someone has developed. It is not a system but a mindset that permeates everyday life. Nevertheless, in recent years Jugaad has become a buzzword in innovation at industrial scale.

It is first and foremost Tata's ultra-cheap car Nano, which has led many Western companies and designers to turn their attention to Jugaad. The Nano has become a symbol of how companies that are working under severe constraints, may be able to develop products that are attractive and useful, but also so cheap that they open up a whole new market segment; the huge urban middle class of the developing countries.

Quick fixes are not sufficient

It is ironic that while scores of books and reports are published to teach western companies about the benefits of jugaad, most Indian developers seem to want to move beyond it. From their perspective, jugaad is not sufficient to develop solutions that can compete globally.

Rishikeshi Krishna, professor at the Indian Institute of Management in Bangalore, believes it is essential that Indian companies learn to be more systematic in their innovation. Jugaad solutions are usually not scalable. Often businesses run into problems when they attempt to produce on a large scale, precisely because their solution is improvised and short-sighted, and not thoroughly thought through from the start.

"In fact, I am starting to be a bit irritated by this phrase, Jugaad," said Dhananjaya Dendakuri, founder of Achira labs, a small high-tech company in Bangalore that develops ultra cheap tools to diagnose diseases.
Dendakuri graduated from MIT in the U.S., and in his opinion, the reason why it has so far been rather limited, what Indian companies have managed to develop in terms of products that can compete internationally, is specifically that Indian engineers have trouble moving beyond creating quick fixes.

"Jugaad is good for ideation and finding a quick response to a challenge – but that's not how research and development on a global level works," says Dendakuri.

Yet the first thing you notice as a visitor to Achira's development lab, is a large, old wooden loom – a Jacquard loom, which can be programmed using punch cards to weave intricate patterns. In Achira lab the loom is used to weave prototypes of the special textiles that the companies aims to use instead of paper indicators of paper for blood tests. By varying the patterns of a woven tissue, the flow of blood can be directed to the chemicals embedded in the fabric, which the blood sample is meant to react with.

The old wooden loom, standing among the sleek modern equipment for creating advanced computer chips, seems an appropriate metaphor for the use of jugaad innovation in a professional, modern industrial development process: 3D printers and lasers are fine tools - but if an old loom can be useful in the context, why not use it? It is inexpensive, and it allows you to draw on a wealth of traditional knowledge and crafts.

Flexibility

Driving past the guard and in to the Tata Management training center in the city of Pune, feels like entering a parallel reality. The noise, dust, crowds and waste right outside the gates disappears and instead you find yourself in a lush and manicured park, with a big, beautiful mansion from the colonial era. This is the internal training centre for managers and leaders of India's largest corporation Tata. The Tata Companies, in addition to manufacturing and delivering multiple products and services to the Indian market, has also become an internationally known brand - not least after launching the Nano car, and through the acquisition of the Land Rover and Jaguar car brands.

Many of the participants in the management courses come from the West, and Senior Practice Consultant Dr. Rajiv Narvekar explains that the most important thing they learn in India is to work with ambiguity and uncertainty:
"You learn that you cannot expect sophisticated systems or guidelines for everything. You simply have to experiment. You learn that there are many ways of doing things, so you can probably find another solution if your first plan does not work ".

The Indian approach doesn't always lead to beautiful and durable solutions, but sometimes it can lead to products that fit the users' context very precisely – solutions that are just right.
Prof. K. Munshi, at IIT's Design School in Mumbai calls it "design by default", and he calls the development of products like the ubiquitous three-wheeled taxi (tuk-tuk) a "successful accident". It is not pretty, but it is robust and simple, and it works.

As Ranganath Krishna, Director of Grundfos India, observes, Indians have to make decisions and find new solutions all the time. In comparison, Danes tend to think in very linear fashion, he says: They have difficulty changing and taking fast decisions.

The power of constraints

Overcoming constraints is a way to force out new development - and as Grundfos' Krishna notes, life in India is one big constraint.

In the rich, Western world many designers struggle to come up with new, previously unimagined needs for people who basically have everything already. Companies are trying to find some marginal extra features that can separate their product from the competitors' and hopefully tempt the customers to replace their old equipment with a new, more advanced version.

For an Indian engineer, however, the main challenge is to deliver something that is affordable enough for the costumers to buy it. The starting point is not abundance, but scarcity - and that calls for a completely different type of solutions.

First of all, there is a relentless focus on price. Customers can not afford or they do not want to pay for more than what it is absolutely necessary. This holds especially true for "invisible" products like technical components, says Grundfos' Krishna: "With bags, clothes and other consumer goods, people are willing to pay a little extra to acquire the status. But this does not apply to components like pumps or valves".

The danger of slipping into the high end

Godrej is another, well-established Indian industrial conglomerate, and their production extends from the space industry, to robotics, the construction of buildings, and down to white goods and furniture.

Interestingly, it was Harvard professor Clayton Christensen, who initially inspired Godrej to adopt their current strong focus on frugal solutions. In his book "The Innovator's Dilemma" Christensen demonstrates, how companies, as their products mature, are likely to move gradually up towards more advanced features and higher prices.

Godrej realized that this tendency to "slip into the high-end" meant that they actually threw 80% of the market away.

Upinder Razdan, managing director of Sauer-Danfoss' office in India, has a similar observation: "It's fine to move upwards in refinement, as long as the economy grows and the market's demands are moving up as well. But if you are not in touch with market needs, you lose relevance ".

Sauer-Danfoss makes hydraulic components for tractors, and currently the greatest growth in sales of tractors is in China and India - but the requirements there are quite different than in the West. Traditional Danish marks of quality: Safety, low noise, precision, durability and environmental friendliness mean less in the emerging markets – whereas the price is crucial.

If Danish companies intend to sell beyond the premium end of the market, they will be challenged to re-consider some of their fundamental values.

"At Sauer-Danfoss, we have a slogan, that our components last a lot longer than the machines they are installed in," says CEO Upinder Razdan: "But is there really any reason for that? In a business perspective it doesn't work".

Grundfos' Krishnan has a similar observation: "Our pumps are designed to last for at least ten years and they are highly energy efficient. But what if you are selling a pump to a man who only has power 4 hours a day and who only uses the pump in order to pump water into a container, so he has enough until the next time the water supply is opened - will this high efficiency make a difference to him?"

Customer Understanding

Not surprisingly, it is important to know the market well, if one is to understand what customers want. "You've got to jump in the fishbowl, if you want to understand fish" says Godrej's Head of development G. Sunderraman.

During the development of Chotokool, a very cheap and compact refrigerator designed for families and small retailers in the country, Godrej's designers went to visit potential customers in villages many times to understand their needs. Later in the development process, the designers returned with prototypes and collected more responses and ideas from end users. In total, the team spent 50 days with users in villages.

Chotokool is a refrigerator with a 43 liter volume, designed for a family. Cooling is done using so-called "Peltier" technology. It draws only between 40 and 60 watts. Chotokool can operate from batteries or solar cells.
The box is made of plastic and the entire unit is assembled from a total of 20 parts.
The Chotokool is opened from above, so the cold air stays down in the box.
The price is Rs. 3,400 - approx. US$ 65.

Similarly, GE Healthcare India has an explicit strategy to develop low-cost healthcare solutions based on a thorough understanding of the end-users' conditions. The strategy is called "In India, for India" and it has parallels in several other countries.
GE Healthcare's Director of Marketing, Maternal Infant Care for Emerging markets, Ravi Kaushik talks of the importance of listening to VOC - "the voice of the customer" - and he mentions that GE during the development of one of their devices for newborn care did interviews with more than 65 users

Also, to avoid that answers would be tainted by the interview situation, the end users that were interviewed, were not told which company was conducting the research. GE had someone else other than the persons on their product development team involved in the needs understanding to conduct the interviews, in order not to have the design team themselves to act defensive or persuasive when discussing the product with the users.

Prioritizing

When the price needs to be *really* low, product managers are required to make tough choices. As GE's Kaushik puts it: "Basically, I only use three buttons on the remote control for my TV. In the same way, we try to understand what are the three most necessary buttons on the devices we develop".

So how do you prioritize? "Ask the customer," says Ravi Kaushik: "We take the tough decisions together with users".

Professor K. Munshi from IITs School of design explains that you must have empathy for the end user, in order to understand their situation. As an example of how this insight can be used, he shows a rechargeable lamp with LED light bulbs that is designed for people who do not have electricity installed. The lamp can be charged using a charger for a mobile phone. This brings down the price, because practically everyone already has a charger for his or her mobile phone.

GE uses a number of methods to pinpoint what users prefer. One of them is "the hundred dollar test": You tell the user, if you have $ 100 - what would you pay for the different features of the product? Then you tell the user what the features actually cost and make them select the features by ranking and rating them.

Godrej uses a different method, sometimes called "forced rank": It gives the user a series of cards with the various features of the product can provide. In the case of the small refrigerator Chotokool, there were cards for cooling drinking water, keeping milk fresh, storing leftovers, storing vegetables etc. The users were asked to arrange the cards according to what functions were most important to them. This made it possible to identify the features that best could be omitted, and to determine which temperature and size of the fridge that it was absolutely necessary to deliver.

Social needs, basic needs

When companies engage in creating solutions for the lower segment of the market, one might expect that there was a significant element of CSR involved - but this is hardly the case. Generally, there is a clear perception that it must be profitable – even at the base of

the pyramid. As Devi Shetty, founder of the Narayana Hrudyalaya chain of hospitals puts it: "Charity is not scalable, good business is."

In other words, if a solution is not viable economically, it is not a sustainable. This, of course, does not mean that engineers and companies cannot also be driven by a strong desire to make a difference for a lot of people who have great needs.

In fact, Godrej's Sunderraman believes it is essential that you have a "noble mind". You must have ambitions to solve real, fundamental problems - and there are plenty of those in India; water, health, electricity, better roads, energy, housing, etc.
For Godrej, it is about seeing today's social needs as tomorrow's business opportunities.

Quality Vs. price

Jos Van Haaren, head of Philips Healthcare Device in Bangalore explains that there is a "window of consideration" in the market. If you are able to reach a specific, low price point, your products will be considered by the target audience - not otherwise.
In the case of Philips, one of their challenges is selling to the many small private hospitals in India, which typically have only 25-50 beds. These clinics can only handle relatively simple treatments and they cannot afford expensive gear. If a piece of equipment costs more than 100,000 rupees - equivalent to US$ 1.900 - it simply falls outside the window of consideration.
As Apollo hospitals' Prof. K. Ganapathy puts it: "Whatever the solution, if it is not affordable, it is not a solution".

Grundfos' Krishnan points out that a low price does not necessarily mean that the product is cheap. A large share of sales of shampoo, soap powder, creams, etc. in India are in small sachets, typically costing just 10 cents. Although, it's a small amount, it is actually a much more expensive way to buy shampoo than if you bought a whole bottle. But for the large group of Indians who earn between 100 and 200 dollars per month, a whole bottle is too large an investment.

Another way to reach the critical price point is to provide the right financing: Tata Nano car is aimed at people who are currently driving with the whole family on a motorcycle. That's why Tata offers an installment plan for the Nano with the same monthly payments as for a motorcycle.

Micro-payments

In the healthcare sector, many people are not treated because they cannot afford the bill. Less than 20% of Indians have health insurance, and the public hospitals are generally crowded and often inadequate.

The Narayana Hruduyalaya chain of private hospitals has cooperated with the Indian state government to create an extremely inexpensive health insurance. For about 75 cents a month a person is covered for over 1600 different types of major surgery. The insurance applies only to treatments where you are hospitalized for more than 24 hours. Of course it would be better to have complete coverage of even minor illnesses and injuries - but it would make the insurance much more expensive, and therefore unavailable to most people. By limiting the insurance to cover only rare, but expensive treatments, a very broad range of people can afford to guard themselves against complete ruin.

4 million people are currently covered by this "micro-insurance".

Bharti Airtel is a mobile telecommunications company that has outsourced virtually all parts of its operations – including network operations, customer service and billing.

In this way, Bharti has managed to lower the price of phoning to less than 1 cent per minute, and this low price in turn sparked an amazing boost of the Indian market for mobile telephony. Currently, there are over 800 million mobile phones in use in India.

Simple, but driven by a different mindset

Many Western companies have certainly discovered the low cost challenge, and they are scrambling to develop product lines that can give them access to the middle class in India and other emerging markets.

Grundfos has recently decided to assemble a team of Indian engineers in order to develop pumps for what they label “the B market”.

Philips and Sauer Danfoss also have products in the pipeline developed specifically for what the two companies call the "value segment".

These foreign companies all develop the new products in India, and with teams, which are staffed by local engineers and designers.

In many cases, local adaptations are based on very simple ideas – but, mind you, ideas that western developers never would have come up with, because they do not fully understand the context, that a product is used in.

Philips Healthcare has developed a high-definition video camera, which can be used by clinicians, so they can see patients at a distance.
For the version sold in India, the Indian engineers put the unit on wheels so it could easily be rolled around to different beds.
The Western designers had imagined that there would be a camera mounted at each bed – which fits well in western hospitals with single-or two-bed rooms, rather than Indian hospital rooms with 10-20 patients.

Similarly, Philips lowered the price of a hospital bed by removing the electric height-adjustment feature, which makes entering the bed easier. Instead, for the Indian version, the bed is fitted with a footboard. This had the side effect that it is faster to use, because there is no waiting for the bed to be electrically moved up and down.

While GE often develops products from scratch, in some cases the approach is to *de-feature* existing solutions by removing some functions or components, based on an understanding of what are essential needs of the end-users. As Ravi Kaushik puts it, one should preferably be able to offer 50% of the functionality at 20% of the price. One example is GE's Lullaby baby warmer for premature babies. In the premium model made in USA, the bed can be tilted by means of an electric motor. On the less expensive Indian model, the motor control was replaced with a crank and handle. In an upcoming, even lower priced version, the crank handle might be removed. Instead, they might now simply put a wedge under the mattress.

These are certainly examples of classical jugaad thinking.

Turn the perspective around

For Danish companies and Danish engineers the greatest obstacle to developing more frugal solutions may be their traditional professional pride. It is deeply rooted in the Danish self-understanding that we should deliver products that are at the forefront, with new features and better quality.

As Ranganath Krishna from Grundfos sees it, the Danish concept of quality means that Danish engineers, who try to develop low-cost solutions with fewer features and lower technical specifications, will tend to think of the result as inferior compared to the level one should rightly aim for.
But Mr. Krishna believes that this is because the Danes already have the more expensive

and advanced solutions to compare with. Instead one should turn the perspective and see things from the point of view of the Indian end-users: The solutions they have access to at the moment are poor and have limited functionality, so even a simplistic Danish product will be seen as a clear improvement – if it is affordable as well. For the Indian user the low cost western product is not a step down, but a step *up* in quality.

Consistent performance

Where can you *not* compromise as a Western business? Both Sauer Danfoss and Grundfos say that the crucial part is *consistency* - the product must deliver what it promises. It is not acceptable to sell equipment that only works occasionally, or varies in performance.

If you are a Western brand, you can lower the technical specifications, but it must still be absolutely clear to the buyer, what he is getting: There should be no surprises in quality or uneven performance.

A manufacturer of cheap tractors could for example accept that there is a bit more slack in the steering if the hydraulic motors in turn are 30% cheaper. But it puts the credibility of the manufacturer at risk if it is not clear from the outset exactly how much more slack there is in the cheaper model.

For GE, it is also essential that the customer know exactly what they can expect from the product. GE insists that all equipment, even their low-cost product series, must be 510K approved (designed to the American FDA standards) and the European CE health, quality and safety regulations.

A similar philosophy is apparent in the large Indian private hospitals that go to great lengths to meet the key critical indicators of quality; survival rates after surgery, infection during hospitalization, etc. They benchmark their services with the best American hospitals - and do quite well in the comparison. The Indian hospitals are focused on low cost, but for the core service - getting well – there are clear figures on what patients can expect.

Lower cost, higher benefits to the end user

In some cases it is possible to achieve *both* savings and some new functionality, which is relevant to the local context.

GE wanted to develop a lower cost ventilator for hospitals, and they chose to base it on a technology that does not use a compressor, and therefore is less expensive, and consumes less power.

The technology was already used in GE's respiratory devices intended for home use. However, the small models are not powerful enough for intensive care patients. The solution, therefore, is for hospitals to buy a mix of large and small ventilators

The lower cost model also has the advantage that it can run on a backup battery for 3-4 hours - which can be useful if the power is interrupted, and you cannot breathe unaided.

When Tata's engineers were developing a cheaper seat for the Nano, they wanted to eliminate the metal base plate, which car seats are usually anchored on.
To achieve this, they made the frame of the seat wider and mounted it directly on the car frame.
The result was fewer material costs, reduced weight - and, as it turned out, improved safety in crash tests, says VR Shet, general manager of Tata Motors.

Dr. Devi Shetty, founder of the Narayana Hrudyalaya hospitals, believes that high cost in many cases is a sign of neglect or poor organization. As an example, he mentions pressure sores in patients, who are bedridden for a long time. Bedsore involves complications and additional costs of treatment and it is primarily due to the staff not being sufficiently attentive.
As Shetty says, it's expensive *not* to do things properly.

Cannibalization
A typical objection against respected Western brands trying to develop low-cost solutions is the fear of damaging the brand - or the risk that introducing low-cost products will cannibalize the company's higher priced and more profitable products.
The response from GE's project manager Oswin Varghese: "It is our experience that the fear of cannibalization should be far, far less than the beauty of gaining a much larger market. Moreover, it is surely better to lower the price yourself before your competitors take away your customers. You need to change anyway. "

Ranganath Krishna from Grundfos points out that many Western companies have no problems offering an array of competing brands in different price ranges. One example is Volkswagen whose range of cars spans SEAT, Skoda, VW, Audi and Porsche. Often car models from the different brands share both platform and a large part of the components, but this does not damage the perception of any of the brands.
Similarly, P & G and Unilever both have an untold number of sub-brands, each of which is probably better known to consumers than the parent company itself.

Ranganath Krishna sees Danfoss' acquisition of the Chinese manufacturer Holip as a good example of how an established Danish brand can expand to offer products in the lower price range by having a sub-brand.

Bottom-up innovation
There are basically two different approaches to developing of a low-cost product: By

gradually removing features and parts from an existing, more expensive product (like GE in many cases have done) - or by starting from scratch.

Tata Nano is the classic example of starting from scratch. The starting point was the price, which was announced by Tata's group chairman, Ratan Tata: 100,000 rupees - three times lower than the cheapest new car on the market at the time.
The extremely low price meant that the engineers had to completely rethink what a "car" needs to offer - and this gave them the freedom to design a car without power steering and with the engine placed in the rear.

Tata has made several other products, including Tata's Swach water filter (which was introduced at 999 rupees – approx. US$ 19) and their new low-cost housing, where prices have been fixed from the beginning - in contrast to the normal procedure where the price is reached by adding up the sum of the components.

Tata lowered the cost of their Swach water filter by introducing rice husk ash, normally a waste product in the agricultural sector, into the filter unit. Over half a million units were been sold in the first year of launch.
The Tata Swach team now believes that there is potential to make the product more affordable to really reach the base of the pyramid.
They are exploring various design and technology alternatives to further make the product even more affordable.

Disruptive innovation takes courage

Many are convinced that it's only possible to create radically cheaper solutions by starting from scratch with a completely new team – and in a setup where you do not need to take existing products and traditional ideas into account.
In an established company, this type of disruptive innovation requires support from the executive level. Ratan Tata, the group chairman, was personally involved in the development of the Nano, and in the case of the small fridge Chotokool, it was regarded as the first step in a long-term strategy from Godrej's CEO, Jamshyd Godrej, to develop more innovative products for the lower end of the market.

Developing something completely new also requires a certain courage from the project manager. Being in your early thirties helps manage a disruptive project as the project manager is ambitious enough to take relatively higher risks. More often than not, senior managers are reluctant to put their careers at risk. Consequently, the project manager on the Nano was in his early thirties, and the average age of the engineering team was around 27 years.

Tata encourages their employees to take chances by giving an annual innovation award at a grand ceremony, attended by about 600 senior executives from various Tata Companies. The prize is awarded by Ratan Tata himself, in 3 categories: for innovation that has emerged as a commercial success, for innovation that are in “the leading edge”, and finally for innovative projects, in which the team members have done their utmost - but failed. "Dare to try", is the title of the award.
This explicitly signals that it is okay to take chances within Tata – as long as you learn from the failures, and if you show that you are raring to embark on new projects again.

A great idea is not enough
It is one thing to come up with a good idea for a cheap product, but quite another to actually produce and sell it. Through a number of iterations, GE has over many years brought the price of their baby warmer down from $ 8,000 to $ 3,000 - and are now planning the next version, at an even lower price, thanks to changes based on GE’s continued observation of end-users’ needs.

As Ravi Kaushik observes, lots of low cost healthcare products are designed around the world and though they may win many awards for innovation and get lots of attention, they often struggle in launching, manufacturing, scaling up, selling and servicing such products.
Kaushik’s point is that it requires much more than a good idea to reach a mass market. The hard part is the long haul; organizing the production, creating the packaging, finding distributors, clarifying warranty and service, and not least, providing medical results to validate that the product works in a low-resource setting and is safe. Each step adds new costs.

Godrej's Sunderraman is touching on the same challenge in his comment: "To create a new product is easy. To create a new market is 10 times harder".
Although Chotokool has achieved good sales among small merchants, the mini refrigerator has not yet developed a mass market in private homes.

Tata Nano is also still struggling to make its big breakthrough. As IIM professor Rishi Krishnan says, the large and established Indian companies also find it difficult to develop low-cost solutions: Tata, Godrej and Mahindra's engineers all come from the privileged pool of people who live a life far from the majority's needs and constraints.

It is hardly a coincidence that the greatest successes in developing low-cost solutions have been in healthcare, where the economic pressures are the most extreme.
The price of heart surgery or cancer treatment can drag a family from the middle class and back into poverty, so it is clearly urgent to bring prices down – and to ensure that the treatment works. 82% of Indians have no health insurance, so doctors and hospitals are paid out of the patients' own pocket. When you enter a private hospital, you immediately see the payment counter in the lobby. In the Indian healthcare sector it is impossible to overlook the customers' constrained economy.
This, of course, is in stark contrast to the Danish healthcare system in which neither the patients or the personnel are confronted with the cost of treatments.

It's a volume game
The solution - in virtually all industries - is volume. Solutions need to be scaled, so costs can be distributed, and so all stages of the production process can be optimized and specialized.
"It's a volume game," says Vijay Singh, COO of hospital chain Narayana Hruduyalaya: "We get far more customers by going down in price, but we earn less per customer".

Like many of the private Indian hospital chains, Narayana Hruduyalaya have been inspired by Henry Ford's assembly line and MacDonald's organization of fast food production. Dr Devi Shetty is called as Henry Ford of Heart Surgery.
At the hospital for heart surgery in Bangalore, operating theatres are in use from 5.30 in the morning. The hospital does 30 heart surgeries and more than 1000 patients are consulted daily. The cardiology department for children has 80 beds and, according to Narayana Hruduyalaya, it is the largest of its kind in the world. The department is divided into 4 wards, and with 1-2 nurses attending each child, there is a busy, concentrated atmosphere in the department.

Operations are organized so that the senior surgeon only performs the most demanding parts of the procedure; other surgeons take care of opening and closing the patient. The chief surgeon talks to patients before and after surgery, but has no recurring role in the treatment. The senior doctors also have only a minimum of administrative duties.

In this way, the use of the most expensive staff is maximized and focused on tasks that match their particular expertise. The division of labor also means that surgeons quickly build up a lot of experience and routine - a surgeon typically performs 2-3 operations daily, which adds up to about 1000 operations over 3 years. In comparison, heart surgeons in the UK often reach the age of 60, before they have performed 1,000 operations. This specialization is an important reason why Narayana Hruduyalaya's results are up to the highest international standard.

COO Vijay Singh explains that the large volume of patients means that all resources - equipment, buildings, and staff – are utilized much better. One of the most expensive

appliances in cardiology is a CT scanner. At an ordinary hospital the scanner will usually be used for about 30 scans per day. Narayana Hruduyalaya takes more than 60 scans per day, even offering scans at half price in the late evening hours.

All in all, Narayana Hruduyalaya has brought the cost of a heart surgery, including 10 days of hospitalization, down to approx. $ 2,000 - this is about a tenth of the price in a Western Hospital.
The aim is to achieve a further halving of the price, says CEO Devi Shetty. Part of the strategy to achieve this is to extend the individual hospitals to become "health cities"; clusters of hospitals with different specialties with a total of 5,000 beds. At the moment, Narayana Hruduyalaya in the southern part of Bangalore operates 4 hospitals next to each other with a total of 3,000 beds. This clustering allows economies of scale, for example by having a shared blood bank, and by being able to negotiate very favorable terms with suppliers of equipment and services.

The plan is to expand by building a number of such health cities around India, to reach a total of 30.000 beds over the next 5 years. Some of the new hospitals will be in prefabricated buildings, in a design developed with India's leading construction company, Larsen and Toubroe. The price of these prefabricated units will be about $ 6 million for a building with a capacity of 600 beds. The modules are in one level, avoiding costly lifts, and they are cooled by natural ventilation - partly to avoid the cost of air conditioning, partly because this is believed to create a healthier climate.

Narayana Hruduyalaya is currently constructing a hospital in the Cayman Islands, which is planned to eventually have 2000 beds.

Go with something proven
Another way to exploit economies of scale is to assemble the product from components, which are already used in large numbers for consumer products.
GE's medical equipment is intended for professional and specialized use, but many of the components - lasers, displays, batteries, processors, etc. - are also used in regular consumer electronics.
During the development of the highly successful MAC 400 scanner, it was decided not to use GE's specially designed processor, but instead to use a standard chip, which is produced in much greater numbers - and which costs a third.

The scanner is equipped with a printer. On the more expensive models, the doctor can take a print of the scan on an A4 sheet. The prints raise the price of using the scanner, since it costs ink and special paper. In addition, the printer is one of the parts that most often have technical problems. Instead, for the cheap MAC 400 Scanner, GE decided to use a printer normally used by Indian bus conductors to print tickets. This small printer is extremely robust against dust and impact, and it is inexpensive. By optimizing the software that controls the printing, GE has achieved a very good image quality, which is

adequate for the doctor to assess the scan. In the first mobile scanner – priced at $ 1.200 – the prints are 80 mm wide, but in the later, and even cheaper model – selling for $ 500 – the print paper is only 58 mm wide. It is through numerous such little savings that it was possible to bring the price of a scan down to 25 cents.

Besides printing out scans, images can be stored digitally. In the premium scanners, images are stored in GE's special image format, which allows the doctor to make a range of advanced analysis of the data. It requires, however, that the physician buy a special program to view the pictures digitally. In the low cost Indian scanners images are stored as regular .jpg files, which that can be viewed on any PC.
In project manager Oswin Varghese's conclusion, a good strategy when you have to cut prices is: Go with something proven.

More mobile phones than toothbrushes

India has a very high prevalence of mobile phones. It is said that there are more Indians who have a mobile phone than a toothbrush.
The enormous number of handsets and minutes of airtime sold is in itself an excellent example of how providers have managed to reduce prices enough to open the market for virtually anyone. The fact that almost everyone has a phone also opens up new possibilities for providing useful services at lower prices.

Mobile phones and the Internet can bring expertise right down to the most remote parts of society, and thus empower people to solve everyday problems in a much more efficient and qualified way.

For years, Nokia has been paying close attention to understanding the needs of users in developing countries, and their cheapest phone, the Nokia 1100, which was equipped with a special dustproof keyboard and a built-in flashlight, was for several years the world's best-selling handset.
Its current successor, Nokia X101, costs just under $ 20.

Nokia has established a department in Bangalore with the task of creating "the first Internet experience for the next billion". The next billion Internet users most likely will not use a PC, but a cheap mobile phone, and Nokia are therefore trying to develop information services that are targeted at the poorest part of the population's needs.
The service is called Nokia Life. At present, Nokia Life is based on SMS technology. When you buy a new Nokia phone, the program to receive and store information from the service is pre-installed, and users can - for a fee - choose to subscribe to a range of daily broadcasts of information.

Some information in Nokia Life is entertainment, such as astrology, gossip from Bollywood or cricket results. Other information is more practical: Farmers can receive the market price at the nearest local markets of 3 different commodities. Or you can receive information about diseases such as diabetes, reminders to take medication, or tips on pregnancy and children. There is also information specifically aimed at women who run a small business.

Some information is free, because the service is sponsored by the state or by international organizations like the Bill and Melinda Gates Foundation. The paid subscription starts at approx. half a Euro per. month. Agricultural Information costs one euro per. month. Payment is made through prepaid cards, and you can select down to daily or 10-day subscriptions - or you can even just pay for single information.

Arun Gowda, who heads Nokia Life's healthcare services, sees it as a general platform to reach a large group of people who today have no access to the Internet. As more advanced phones become the norm, the service will expand to offer richer information, and will become more two-way and involve social networks. For example, it will be possible to submit questions to experts online - whether it's agricultural consultants or doctors.

Nokia Life is currently offered in India, China, Nigeria and Indonesia, in a total of 20 different languages. From Bangalore 10 million updates are sent daily, personally target-

ed and based on information about the individual user, such as their location, birthday or child's birthday.

Telemedicine

Telemedicine is another example of how digital technology can make knowledge and service far more widely available.
Many hospitals in India now offer video consultation. Narayana Hruduyalaya cooperates with the Indian government to offer free analysis of ECG measurements of heart patients sent from remote locations. They receive 4-500 scans daily, not only from India but also from Pakistan, Afghanistan, the Middle East and Africa. So far, the hospital has advised 53,000 patients via telemedicine linked to over 400 physicians in India and abroad.

The need is enormous. There is a huge shortage of doctors in India, especially in rural areas. There are big savings for patients that might otherwise have to travel for days with a companion in order to speak to a specialist doctor, if they instead can go to a local clinic with a video connection to a hospital in the city.

Prof. K. Ganapathy, President Apollo Telemedicine Networking Foundation and Immediate Past President of the Telemedicine Society of India, estimates that 80% of the teleconsultations are follow-up interviews with patients who have been discharged after hospital treatment, and who therefore already knows the physician. Other teleconsultations are a first encounter and most of these can be managed remotely. Alternatively they are advised further investigations and if necessary hospitalization.

Ganapathy says that a local clinic can acquire the necessary equipment for telemedicine for as little as $ 2000. In addition to a computer and a video camera, a number of telemedicine enabled medical devices can be used to transmit information digitally to the tele consultant eg transmitting heart sounds through a stethoscope, transmitting blood pressure, blood sugar values, temperature etc .
A doctor is not necessary at the remote end. In fact, Prof. Ganapathy explains that not even a paramedic or nurse is necessary. A school dropout can be trained to establish connectivity and operate the instruments, if necessary, says Prof. Ganapathy.

Reverse innovation

The frugal solutions developed for use in India are also interesting in an international context – not least because the Indian developers are very aware of the possibility of exporting.

GE has an explicit strategy for their low cost development to develop solutions for the local market first, and then spread to other emerging markets, and then to the rich, developed countries.
The strategy is called "reverse innovation".

Both Apollo and Narayana Hruduyalaya hospitals are very outspoken about their ambitions to grow internationally. Apollo is already offering teleconsultations to health care centres i Africa, Bangladesh, Sri Lanke and the Middle East.
Prof. Ganapathy is working to overcome the difficulties concerning medical licenses, liability and insurance, in order to be able to offer telemedicine in other countries.
It seems that telemedicine can become another step in India's already highly successful strategy of providing consultancy services over the Internet.

Some Danish companies are also experimenting with reverse innovation. Foss is an example. For the Indian market Foss has developed a low-cost sensor that can measure the quality of milk. Foss is now examining the possibility of marketing this cheap solution in Western markets as well.
For Foss the efforts to develop solutions for the emerging markets has led to a greater awareness of the importance of being able to offer solutions in the lower price range.

Conclusion

Jugaad thinking is an important tool for addressing future growth markets
This study and analysis of how Indian companies are developing much cheaper products, firmly supports the assumptions behind the Universe Foundation's project on frugal solutions:

Frugality is one of the characteristics that are important in the markets of future. It will be one of the key challenges for Danish companies to learn how to compete in the low part of the market - both because Danish producers will face competition from low-cost producers in the domestic market, and because low prices and frugal solutions are essential in order to address the rapidly growing middle class in emerging markets.

Already today some areas of consumption in the developed markets - such as healthcare – are experiencing that budgets are increasingly squeezed. There are many indications that consumers in the developed countries will become very conscious of choosing solutions that focus on real needs and deliver at low prices
By studying conditions in countries such as India, and by observing the innovation strategies that companies there are using, Danish companies can get an early indication of the approaches, methods and terms, which they can use to develop frugal solutions.

Looking at the methods used in India suggests that frugal innovation would imply a fundamental challenge to the current thinking, organizing and business models of a typical Danish company.
Developments of frugal solutions require you to re-think the whole chain of business: from market research, design and development, through to marketing and distribution, if you really want to compete in the low price segment.

You can read more about the Universe Foundation's project on "frugal solutions" at:
www.frugalsolutions.org

The visited companies and experts

1. G. Sunderraman, Executive Vice President corporate development, Godrej & Boyce, Vikhroli, Mumbai
2. Prof. K. Munshi, Director, Ctech labs, IIT School of design, Mumbai
3. V.R. Shet, Deputy General Manager, Tata Motors, Mumbai
4. Upinder Razdan, Managing director, Sauer-Danfoss India, Pune
5. Siya Ul Haqu, Director – India operations, Headfitted, Pune
6. Dr Rajiv Narvekar, Senior practice consultant, Tata Management training centre, Pune
7. Jhumkee Lyengar, Principal consultant, User in Design, Pune
8. Dr. Jos Van Haaren, Senior director, Philips Research Asia, Bangalore
9. Ravi Kaushik, Director of marketing, Maternal infant care - emerging markets, GE Health, Bangalore
10. Oswin Varghese, Senior Engineering manager, Diagnostic cardiology, GE Health, Bangalore
11. Professor Rishikesha T. Krishnan, Professor of corporate strategy & policy, IIM, Bangalore
12. Dr. Vijay Singh, Chief operating officer, Narayana Hruduyalaya Hospitals, Bangalore
13. Dhananjaya Dendukuri, CEO, Achira Labs, Bangalore
14. Arun Gowda, Manager, Nokia Life, Bangalore
15. Dr. K. Ganapathy, Director, Apollo telehealth services, Chennai
16. Ranganath Krishna, Managing director, Grundfos pumps India, Chennai
17. Anil Nair, CEO and Managing partner, Digital Law and Kenneth, Mumbai